CRSQ

CREATION RESEARCH SOCIETY QUARTERLY

Volume 40 June 2003 Number 1

CREATION RESEARCH SOCIETY QUARTERLY

Volume 40 June 2003 Number 1

Articles

The Wright Brothers' Airplane Compared to Insect Flight Design 1
Arthur L. Manning

The Saguaro National Park (east) Mylonites, Ultramylonites, and Cataclasites: Evidence in Support of the Genesis Flood 8
Carl R. Froede Jr., George F. Howe, and John R. Meyer

Flood Geology of the Crimean Peninsula Part II: Conglomerates and Gravel Sandstones of the Demerdji Formation 17
Alexander V. Lalomov

La Brea Tar Pits: Evidence of a Catastrophic Flood 25
William Weston

Helioseismology: Implications for the Standard Solar Model 34
Jonathan F. Henry

Notes from the Panorama of Science

Natural History or Natural Science? 41
John K. Reed

The Possible Origin of Fossil Wood and Pollen in the Aguja and Javelina Formations, Big Bend National Park, Texas 44
George F. Howe, Emmett L. Williams, Carl R. Froede, Jr.

Departments

Series: *Lest We Forget* by George Howe

Precambrian Pollen in Hakatai Shale, Grand Canyon, Arizona 7
Precambrian Pollen in the Roraima Formation, British Guiana 15
Precambrian Pollen in Russia 23

Book Reviews

The Biblical Basis for Modern Science: The Revised and Updated Classic by Henry M. Morris 16
A Beautiful Mind by Sylvia Nasar 24
Darwin, His Daughter and Human Evolution by Randal Keynes 52
The Right Questions: Truth, Meaning and Public Debate by Phillip E. Johnson 62

Letters to the Editor 53
Instructions for Authors 61
Errata 62
Membership/Subscription Application 63
Order Blank for Past Issues 64

Front Cover
Designed by Michael Erkel.
Insects collected by Evan G. Erkel.
Wright brothers photographs from original glass plates taken by the Wrights, courtesy Library of Congress.

Editorial Staff

Emmett L. Williams	Editor
George F. Howe	Biology Editor
John K. Reed	Geology Editor
Eugene F. Chaffin	Physics Editor
Don B. DeYoung	Book Review Editor
Lane P. Lester	Managing Editor

Board of Directors

Don B. DeYoung, President
Eugene F. Chaffin, Vice-President
David A. Kaufmann, Secretary
Theodore Aufdemberge, Financial Secretary
Robert E. Gentet, Treasurer
Glen W. Wolfrom, Membership Secretary
Eugene F. Chaffin
D. Russell Humphreys
Gary H. Locklair
John K. Reed
Emmett L. Williams
George F. Howe
Lane P. Lester
Michael J. Oard
Ron G. Samec

The *Creation Research Society Quarterly* is published by the Creation Research Society, P. O. Box 8263, St. Joseph, MO 64508, and it is indexed in the *Christian Periodical Index* and the *Zoological Record*.

Send papers on all subjects to the Editor: Emmett L. Williams, P.O. Box 2006, Alpharetta, GA 30023.

Send book reviews to the Book Review Editor: Don B. DeYoung, 200 Seminary Dr., Winona Lake IN 46590.

Authors' opinions expressed in the *Quarterly* are not necessarily those of anyone else associated with the Creation Research Society.

Copyright © 2002 by Creation Research Society. All rights to the articles published in the *Creation Research Society Quarterly* are reserved to the Creation Research Society. Permission to reprint material in any form, including the Internet, must be obtained from the Editor.

ISSN 0092-9166
Published with Corel Ventura
Printed in the United States of America

Haec Credimus

For in six days the Lord made heaven and earth, the sea, and all that in them is, and rested on the seventh.—Exodus 20:11

The Wright Brothers' Airplane Compared to Insect Flight Design

Arthur L. Manning*

Abstract

The Wright brothers' activities in inventing the airplane are set forth. They include library research, conscious imagining of a solution to flight's demands, kite experiments, communication with experts, glider experiments, experiments with a wind tunnel, and propeller design. Then the aerodynamics of insect flight is considered, demonstrating their superb sophistication. It is concluded that since human flight was in fact the result of such a high degree of intelligent planning, certainly the Creator's design is even more directly obvious in the origin of insect flight.

Introduction

This year, 2003, marks the one hundredth anniversary of powered, controlled, manned flight. It is probably commonly believed that the invention of the airplane by the Wright brothers was the result of a couple of ordinary men (bicycle mechanics) tinkering around and somehow putting together a simple machine that managed to fly. In reality, however, their achievement was the result of a highly controlled scientific enterprise. Part I of this article provides an historical overview of the Wright brothers' accomplishment and Part II gives a description of the highly complex flight design features found in insects.

Part I: The Wright Brothers

The Process of the Invention of the Airplane

As far as we know, before 1903 no one in all of the history of mankind had ever succeeded in devising a heavier-than-air machine capable of carrying a man in sustained, powered, controlled flight. Before the Wright brothers' achievement the greatest minds had failed to conquer this frontier. After reading about Otto Lilienthal's gliding experiments in Germany, Wilbur and Orville Wright developed an interest in manned flight; and in the years 1896 through about 1899 they started reading everything they could on the subject. Through this research they learned much from the experiences of others (Kelly, 1989, pp. 46–48).

After realizing how much of a problem others had experienced in aircraft stability and that no one had succeeded in solving it, Orville devised a technique based on controlling the inclination of the wing tips. Then Wilbur devised another technique based on wing warping (Kelly, 1989, pp. 48–50). These inventions showed ingenuity on the part of the brothers. In August 1899 they built a biplane kite and conducted their own experiments on it. They found that they could control it by extra cords attached so as to enable them to warp the wings (Kelly, 1989, pp. 50–51). Thus, the brothers commenced a long process of scientific experimentation.

In May 1900, Wilbur Wright wrote a letter to Octave Chanute (who had experience in gliding), communicating his plans for experimenting with a man-carrying kite (Kelly, 1989, p. 52). This practice of communicating with experts in the field of study is an important part of the scientific method. In addition, it is in keeping with the Biblical wisdom of using a "multitude of counselors" (Proverbs 15:22).

Next the Wrights invented an elevator (a device for controlling the airplane's tilt up or down) superior to previous designs (Kelly, 1989, p. 54). Then they built and experimented with a man-carrying glider. First they worked with it as a kite, and then they actually flew it as a glider. These experiments, conducted in the fall of 1900 at Kitty Hawk, North Carolina, were highly successful (Kelly, 1989, pp. 64–66).

In 1901 the brothers returned to Kitty Hawk and continued their experiments with a larger glider. They began to change the camber of the wing. It is this camber, or height of the wing's curve, which determines the amount of lift that a wing can provide (Figure 1). Camber is actually the height of the wing divided by the distance from front to back. They then adjusted the camber to a ratio of 1 to 18, which improved the glider's performance. Also, during that year, by experimentation they learned more about the center of pressure on a curved surface (Kelly, 1989, p.71). During the latter months of 1901 the brothers built a wind-

---

*Arthur L. Manning, M.S., 431-A Mt. Sidney Rd., Lancaster PA 17602

Received 31 July 2002; Revised 17 January 2003

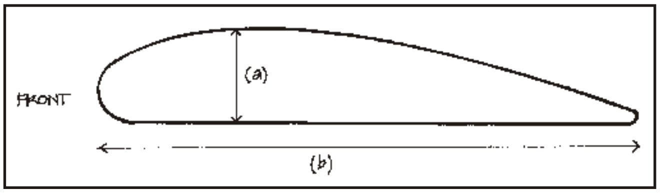

Figure 1. Camber ratio. Side view of wing. The camber of a wing is the ratio a/b seen here.

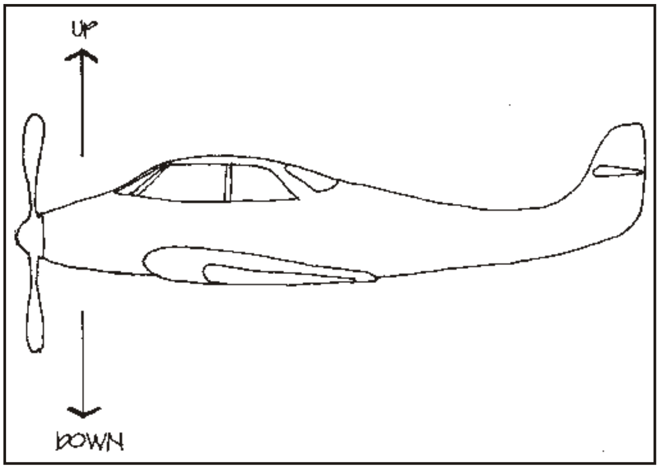

Figure 3. Side view of airplane illustrating "pitch", a vertical movement of the front of the plane.

tunnel and used it to test more than 200 types of wing surfaces (Kelly, 1989, p.76).

In 1902 the Wrights added a tail to the glider consisting of two vertical veins (Kelly, 1989, p.79). The success of these flights demonstrated that they were justified in disregarding the tables of air pressures used by their predecessors and building their gliders in accordance with the data obtained from their own wind-tunnel experiments (Kelly, 1989, p.80). This demonstrated the Wright's quest for and reliance upon empirical data rather than tradition and authority. This aspect of proper scientific research is also in accordance with the biblical admonition to "prove all things" (I Thess. 5:21).

Before the Wrights experimented with powered flight they built their own motor and devised a highly efficient propeller (Kelly, 1989, pp. 85–89). On December 17, 1903, the brothers finally made their historic first powered flight, followed by three others, each successively longer, that same day. According to Orville Wright:

> ...faith in our calculations and the design of the first machine, based upon our table of air pressures, obtained by months of careful laboratory work, and confidence in our system of control developed by three years of actual experiences in balancing gliders in the air, had convinced us that the machine was capable of lifting and maintaining itself in the air, and that, with a little practice, it could be safely flown (Kelly, 1989, p.99).

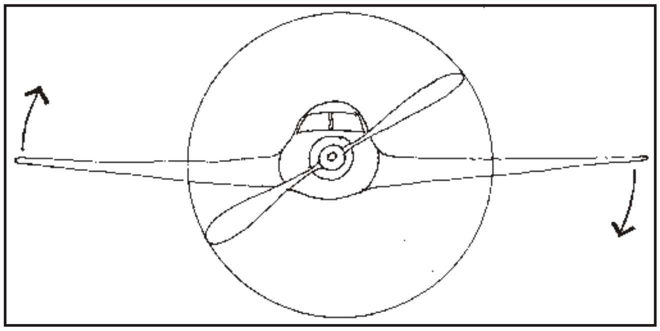

Figure 2. Front view of airplane illustrating "roll", a rotation of the plane about an axis from front to rear.

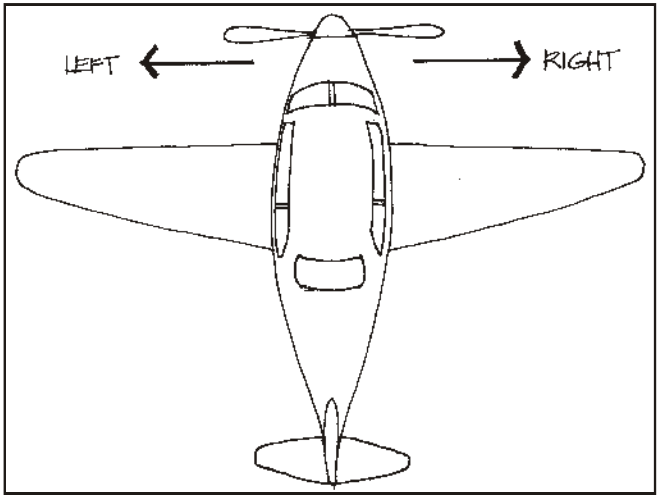

Figure 4. Top view of airplane illustrating "yaw", a horizontal movement of the front of the plane.

The Product

To produce a flying machine the Wright brothers skillfully brought together wings, propellers, an engine, and a pilot. These components had to be of a specific design and composition. In addition, it was essential to have control mechanisms. First of all, it was necessary to control the wings so that there would not be any rotation about a central axis running from the front to the rear of the airplane. This type of rotation is called "roll" (Figure 2). This control was accomplished by what the Wrights called "wing warping".

A second mechanism was necessary to control the movement of the plane's nose in a vertical dimension. This direction of movement is called "pitch" (Figure 3). Orville Wright was able to control pitch by designing an elevator (Wright, 1953, p. 14).

A third mechanism was necessary to control the plane's nose from moving right or left, a movement that is called "yaw" (Figure 4). The device used to control this movement was a vertical rudder in the rear of the plane which was originally controlled by being connected by wires to the cables that caused wing warping. Later this was changed so that the operator could control the rudder separately (Wright, 1953, p. 19).

This brief analysis of the use of design and controlling devices by the Wright brothers shows that they left little or nothing to "chance" in their labors. A study of insect flight will likewise show amazing evidence for design.

Part II: Insect Flight

More than 99.9% of all insect species exhibit flight (Dudley, 2000, p. 10). There are more than one million winged insect species described and they can be found "... in essentially all terrestrial ecosystems, and on all continental land masses, including Antarctica" (Dudley, 2000, p. 3).

Some insects are phenomenal fliers. Horseflies are said to be able to fly at speeds up to 30 mph (Dalton, 1975, p.26). Some dragonflies and hawkmoths can attain speeds of up to about 38 mph (Brackenbury, 1992, p. 118). The housefly can travel 250 body lengths per second, compared to 80 for diving swifts, and only 5 or 6 for humans (Brackenbury, 1992, p. 118). "Swarms of locusts occasionally make landfall in the Caribbean islands after being carried from breeding grounds in North Africa, several thousand miles to the east" (Brackenbury, 1992, p. 120). Monarch butterflies migrate 4,000 miles from Canada to Mexico (Brackenbury, 1992, p. 120). Acceleration rates of up to 9 times the force of gravity (g's) have been observed in some dragonflies and "acceleration at the transition from hovering to forward flight in hover flies and in bee flies reaches... up to 18 g's" (Brodsky, 1994, p. 71). "...[A]bout 23 million wingbeats were obtained in a tethered simulation of long-duration flight using a single *Drosophila melanogaster* (fruit fly)" (Dudley, 2000, p. 59). In order for insects to have such amazing capabilities, it is evident that they are, indeed, not the product of chance; but, in the words of the Psalmist, are "...fearfully and wonderfully made" (Psalm 139:14).

The flight of insects is very different from the flight of the Wright brothers' airplane. But the same basic features are present in both: a means of power (muscles instead of an engine), a means of translating that power into thrust (moving wings instead of a propeller), aerodynamic structures to provide lift (flexible wings instead of fixed wings), control mechanisms (for controlling flight in three dimensions), and control (an insect's nervous system instead of that of a human pilot).

Muscles, fuel, and oxygen

The Wright brothers' "Flyer" was powered by an engine which used fuel, burned in the presence of oxygen. The power for insect flight is provided by muscles which use a different kind of fuel, consumed with oxygen, also. Unlike vertebrate flying animals, insects have no muscles in their wings (Dalton, 1975, p. 19). Their flight muscles are in the thorax. The base of each wing is attached to the thorax by an axillary apparatus, which includes sclerites, small bodies which act as fulcrums. In some cases the muscles pull directly on the wing base and sclerites (direct muscles), but in other cases the muscles pull on the thorax itself, changing its shape and causing it to pull on the wings (indirect muscles). The muscles function on both the down- and the upstroke. "Wing elevation in all insect orders is primarily attained through action of indirect dorsoventral muscles" (Dudley, 2000, p.44). As muscles connecting the interior dorsal and ventral aspects of the thorax are contracted, they pull these surfaces together, levering the wings upward (Figure 5). The muscles themselves are similar in insects and in birds; but insect muscles can generate far more force than those in birds or bats, since they can contract many more times per second, making them "...the most powerful muscle known in any animal" (Brackenbury, 1992, p. 36).

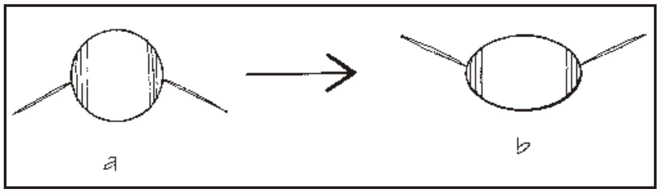

Figure 5. Simplified diagram of wing elevation through indirect dorsoventral muscle contraction. The wings at the left (a) are elevated by contraction of muscles (b).

In insects, the fuel is either fats or carbohydrates. Fats are best for long distance flying, such as in locust migrations; while carbohydrates are best for fast, short distance flights, such as those made by bees. The fuel is delivered to the muscles by the blood (Brackenbury, 1992, p. 36). Flight muscle contraction not only enables insects to fly, it also accelerates the insect blood circulation, bringing fuel to the muscles more efficiently when it is most needed (Dudley, 2000, p. 163).

Insects need an enormous amount of oxygen when flying—up to 400 times the amount they need at rest (Brackenbury, 1992, p.43). "...[T]he thoracic muscles of insects in flight exhibit the highest known mass-specific rates of oxygen consumption for any locomotor tissue" (Dudley, 2000, p. 159). In insects, oxygen is not delivered to the muscles by the blood (as is the case in birds and bats), but through a system of air tubes (called tracheae) which bring in air from the outside through openings called spiracles. An insect can move its abdomen in such a way as to cause minute balloon-like sacs in certain regions of the tracheae to expand and act like a bellows, pumping air through the tubes (Brackenbury, 1992, p. 43). In addition, the thoracic muscle pumping during flight contributes to air flow through the tracheal system by compressing and expanding various tracheal tubes and tracheoles (the ends of tracheal tubes) (Dudley, 2000, p. 162). When the air sacs in some insects expand, the anterior spiracles open and the posterior spiracles shut. Then when the air sacs are compressed, the anterior spiracles close and the posterior spiracles open. The result is a one-way movement of air through the body, bringing in fresh air and expelling stale air (Brackenbury, 1992, p.43). Complex, coordinated systems, such as this one, are hardly what one would expect to develop by chance mutations and natural selection. At the tracheoles, oxygen leaves the respiratory system and enters into the muscle cells where it is needed. The thickness of the tracheole walls is important for the diffusion of oxygen through them. Dudley comments perceptively that "... structural design would appear in this instance to closely approximate the optimal value for effective oxygen transport" (Dudley, 2000, p. 161). Even a tiny detail, like the thickness of the tracheole wall, contributes to making insect flight feasible and appears to be the work of a Master Designer.

Wing movement

According to Dalton, insect wing movement in flying is more complex than that of birds (1975, p. 22). When a bird flaps its wings it changes their length by flexing and extending joints in the shoulder, elbow, and wrist. Insects cannot change the length of their wings, and in this respect are more similar to airplanes. But insects can deform the contour of their wings and rotate them about the longitudinal axis to a much greater degree than can birds (Dudley, 2000, p. 333). Torkel Weis-Fogh "...points out that as insects move their wings in an extremely complicated way, they produce fluctuating and unsteady airflow by means of a variety of novel aerodynamic mechanisms" (Dalton, 1975, p. 24). I think that such extreme complexity points to an extremely intelligent Designer. "[A]s soon as flapping starts and a flow of air passes around them, [the wings] change shape and become cambered into more efficient airfoils" (Dalton, 1975, p. 24). Brodsky lists four different wing deformations (1994, pp. 44–46). As the wing moves up and down it twists first one way, then the other. A fly's wing moves in an ellipse or a figure eight and this creates a "...current of air backward and downward, providing both lift and thrust" (Dalton, 1975, p. 25).

Some rates of wing beats for different insects in wing beats (up and down) per second are as follows: medium butterflies: 8–12, large dragonflies: 25–40, bumblebees: 130, houseflies: 200, honeybees: 225, mosquitos: 600, and gnats: 1,000 (Dalton, 1975, p. 26). As for the extremely high rate of wingbeat of gnats, Dalton reveals that:

> ...there are peculiar aerodynamic problems at these speeds that make the normal properties of airfoils change. In these conditions the insect is not flying in an aerodynamic sense at all, but rowing its way through the air....A very sophisticated method of propulsion indeed (p. 48).

Dragonflies can make their forward and rear wings beat in unison, completely out of phase, or anything in between, depending on their need. They can make such changes instantly while in flight (Brackenbury, 1992, p. 142). Dragonflies' four wings each functions independently, enabling these insects to perform complex maneuvers (Brackenbury, 1992, p. 115). Members of order Diptera (flies) also have independent movement of wings on opposite sides (they only have two wings), but the mechanism responsible for this is different from that in dragonflies (Brodsky, 1994, p. 186). These three common insects—gnats, dragonflies, and house flies—are phenomenal illustrations of God's handiwork.

We do not fully understand all that takes place in the insect body which contributes to flight. Dudley explains that this is because of a high number of interacting structures, such as the 16 muscles used to control a fly's wing, resulting in complex mechanics (2000, p. 50). Of course, all of human history (including the Wright brothers' achievement) teaches us that complex mechanics is the product of master mechanics.

Wing and Thorax Morphology

Insect wings are not modified limbs, as is the case in flying vertebrates. The wings consist of two thin layers of chitin, strengthened by a network of hollow veins (Dalton, 1975, p. 18). Wing strength and flexibility are essential to flight. These qualities come from "...polysaccharide chitin microfibers embedded in a protein matrix...[which makes it]... the finest zoological example of this mechanical design" (Dudley, 2000, p. 36). The wing's flexibility actually imparts considerable strength to it (Brackenbury, 1992, p.102). Dudley describes a gradient of wing stiffness from base to tip and also from leading edge to trailing edge (p. 55).

In addition, extra strength is imparted to insect wings by pleating. Pleating in insect wings not only enables them to be folded away but produces extra strength needed to resist the stresses of flight (Brackenbury, 1992, p. 85). Most insect wings only weigh a few millionths of a gram (Brackenbury, 1992, p. 82). The ratio of wing mass to body mass varies from 0.5% to 10% (Dudley, 2000, p. 55). It is important that insect wings are so light because when they are flapped so rapidly their inertia produces a great increase in resistance (Brackenbury, 1992, p. 82).

Other structural features which enhance wing performance include microscopic hairs (which prevent turbulent eddies from forming) (Brackenbury, 1992, p. 142); small vein-supporting brackets; spines; scales; and sensory structures (Dudley, 2000, p. 57). Finally, the hemolymph (insect blood) pumped through the wing veins apparently helps to keep the wings from drying out and becoming too fragile for flight. Anteriorly within the wings, circulation is caused by pressure induced by the heart; but posteriorly, circulation is caused by accessory pumping organs located at the base of the wings (Dudley, 2000, p. 53). So we see that even the complex wings themselves plus the structures required to produce their complex movements are apparently insufficient to produce flight. Additional organs are necessary, increasing the complexity of the entire flight system, and decreasing the already remote likelihood of its origin by chance.

In addition to complex wings, insects also have a specialized thorax to enable them to fly:

> The thorax of the insect, to which the wings are attached, is a complex of flight muscles and mechanisms so utterly sophisticated as to boggle an aircraft designer's imagination. The thorax enables an insect in flight to carry out just about any maneuver, to loop, swoop, climb vertically, fly upside down, sideways, backwards, to hover, and to vary between all of these in a fraction of a second (Dalton, 1975, p. 19).

The wings are attached to the thorax by a series of couplings which allow movement in any direction, much like a ball-and-socket joint (Dalton, 1975, p. 19). As already mentioned, within the thorax are sclerites — hard, small, peg-like outgrowths from the wall of the thorax which serve as a fulcrum for the movement of the wing and also as points of attachment for small muscles that alter the angle of attack of the wing during flight (Brackenbury, 1992, p. 16). There are also "...many elastic, rubber-like elements in the flexible wing base... to absorb the repeated shocks and reduce the frictional stresses..." (Brackenbury, 1992, p. 17). Extra chitin reinforces the wall of the thorax to help the wing pivot to withstand the stresses of rapid flapping (Brackenbury, 1992, p. 20). Since dragonflies use dorsoventral muscles for both upward and downward flapping, this causes additional stress on the thorax which is alleviated by an internal projection called an apodeme (Dudley, 2000, p. 49). If all of this complexity within the insect's thorax would boggle an aircraft designer's imagination, it must be the product of One with an even greater imagination.

Control Mechanisms

Attached to the sclerites, insects have small muscles that alter the angle of attack of the wing during flight (Brackenbury, 1992, p. 16). Flies have a total of eighteen such muscles (Dudley, 2000, p. 45). Locusts can use their flexible abdomens as a rudder (Brackenbury, 1992, p. 131). Some insects can turn in flight by extending a hind leg in the direction they wish to turn. This interferes with the motion of the hind wing on that side resulting in a turn in that direction since the opposite wing then produces a greater relative force (Brackenbury, 1992, p. 131). Some insects obtain aerodynamic control by structurally determined changes of the wing shape during flapping; but in dragonflies the wing shape is altered by a small muscle located at the wing base (Dudley, 2000, p. 61).

Control of Flight

"...[S]o advanced and automatic is the flight adjustment mechanism of most insects that they are incapable of falling from the air, enjoying a perfection of flying ability to make most pilots loop with envy" (Dalton, 1975, pp. 23–24). The nervous impulse to fly begins in the thoracic or abdominal ganglia "...and is regulated by a complex network of ganglial interneurons" (Dudley, 2000, p. 174). In one type of flight muscle (called synchronous) the neurons regulate the frequency and amplitude of contraction (Dudley, 2000, p. 172). The other type of insect muscle (called asynchronous) requires only one nervous impulse in order to contract over and over again (Dudley, 2000, p.175). This explains how some insects can attain such phenomenal wing beat rates as those previously mentioned. Such high rates of flapping would not be possible if the muscles had to contract and recover from each impulse. The nervous system enables flying insects to rapidly and continuously sense and correct any instability by a wide variety of compensatory, asymmetric wing motions (Dudley, 2000, p. 204).

The greatest sensory input is through the eyes. In all insects the region of the brain involved in vision is the largest. In dragonflies this region comprises about 80% of the total brain volume. Compound eyes provide much information to the insect, not only ahead, but substantially laterally, above, and below (Dudley, 2000, p. 205). It is apparent that the insect visual system must be able to rapidly evaluate the nature of the changing environment in order for flight to be controlled (Dudley, 2000, pp. 205–206). One reason for the success of insects in meeting this challenge is the fact that they are capable of resolving light impulses at a much higher frequency than even vertebrates — some flies and bees about ten times as fast (Dudley, 2000, p. 206).

Other sense organs are also involved in flight. Ocelli (simple eyes) are probably used in maintaining stable flight (Dudley, 2000, p. 213). All winged insects have a specialized structure (Johnston's organ), located in the second segment of each antenna, which monitors its bending during flight (Dudley, 2000, p. 213). "On wings, arrays of campaniform sensillae (dome-shaped mechanoreceptors) monitor the rate and extent of local bending" (Dudley, 2000, p. 215). Dragonflies have four beds of hairs between the head and body that send information to the brain about the orientation of the body (Dalton, 1975, p. 29).

Flies have a pair of halteres instead of a second pair of wings. These small knob-like structures oscillate at the same frequency as the wings, and are said to serve as gyroscopes (Dudley, 2000, p. 217).

In addition to having nervous control of flight, insects exhibit behavior which, though not itself flight, relates to flying. Some of these behaviors are quite complex, including placing the feet in the best position under the body, and orienting the body toward the wind in order to experience lift (Brackenbury, 1992, p. 45). Some species have elongated hind legs which they use to leap into flight (Brackenbury, 1992, p.46). Some jumping insects have additional structures to help them get air-borne:

> [M]any jumping insects... overcome the physiological deficiencies in their leg muscles by cranking up a spring that is then held ready to be released at high speed at the appropriate moment. They can thus catapult their bodies into the air at far greater speeds than could ever be achieved by muscle contraction. The principle is ingenious, and the hardware to make it work involves remarkable innovations of design (Brackenbury, 1992, p. 59).

Grasshoppers use a similar strategy with a stretch of elastic cuticle on the outside of the femur-tibia joint of the hind leg. When the cuticle has been fully stretched it is held by a catch until the moment when all the power is released at once (Brackenbury, 1992, p. 59). Our Creator has designed other "remarkable innovations" as well.

There is evidently much more to insect flight than just wing flapping. We see that sensing and rapidly and accurately responding to a wide variety of environmental stimuli through ingenious structures and complex behaviors takes place in these miniature organic machines we call insects, resulting in the marvels of flight that we can observe right in our back yards. What we see is far more sophisticated than not only the Wright brothers' airplane, but any airplane ever built by man's intelligence. "The heavens declare the glory of God..." (Psalm 19:1), but flying insects mightily declare His wisdom.

The Origin of Insect Flight

The following are quotations from previously cited sources regarding their views of the origin of insect flight:

> Assuming that the ability to fly arose somewhere between the Devonian and the Carboniferous, 20 million years of the evolutionary development of winged insects are shrouded in mystery (Brodsky, 1994, p. 79).
>
> Unfortunately, the evolutionary origins of flight in insects are not well known. Paleontological records of transitional forms are absent, and the likely selective forces acting on early winged morphologies can only be surmised, precluding any paleobiological interpretation of this major event in metazoan evolution (Dudley, 2000, p. 261).
>
> The paleontological history of winged insects starts from the Upper Carboniferous (Namurian). Namurian insects were represented by three clearly distinct groups (Brodsky, 1994, p. 88).
>
> We do not know how and when the three main lines of evolution of winged insects diverged... (Brodsky, 1994, p. 98).
>
> As impressive as insect diversity is today, even more remarkable is the fact that most major morphological innovations and indeed insect orders were present before the Mesozoic (245–265 million years ago)(Dudley, 2000, pp. 8–9).
>
> The dragonfly provides an excellent example of the perfection of ancient flight; they have changed very little from their ancestors... about 300 million years ago (Brodsky, 1994, p. 66).
>
> Odonata [dragonflies] is the oldest surviving order of flying insects, and... the aerial equipment of the dragonfly has remained essentially unchanged (Dalton, 1975, p. 28).

So not only do the complex, ordered flight systems of insects make foolish the notion that they are the product of mutations and natural selection; but the fossil record also offers no support for such a notion.

Conclusion

The Wright brothers' airplane was capable of flying because it had an intelligence controlling many specifically designed features which all had to be in place before it could fly. The anatomy of flying insects likewise meets all of the requirements for flight. It has been shown that each of these insect structures required for flight is a highly complex system (composed of specific materials). The logical conclusion is that insect flight is also the result of deliberate design. Furthermore, there is no evidence for a gradual evolution of insect flight. Indeed, without all of the above requirements being met, an insect could not experience flight. Even the evolutionist, Maynard Smith, agreed with this assessment when he is quoted as stating that flight control is "...a prerequisite for the initial evolution and subsequent elaboration of flight" (Dudley, 2000, pp. 203–204). If only one of the requirements for flight were satisfied, the insect would not fly, and even that particular innovation would be selected against because of the disadvantage involved in carrying around useless structures. The more requirements that might be satisfied, the greater would be the selective disadvantage, unless all were satisfied. The only logical solution is that these exceedingly complex flying insects would have to have been initially formed complete. This is clearly antithetical to evolution and supportive of creation. When one compares insect flight to human flight, the vast superiority of the former requires a vastly superior intelligence. Wherever there are people, flying insects exist, and their "message" of intelligent design is so clear that no man anywhere has an excuse for denying the existence of their Designer (see Romans 1:20).

Acknowledgments

I wish to thank Dr. George Howe for his editorial assistance and Rick Herr for drawing the sketches.

References

Brackenbury, J. 1992. *Insects in flight*. Blandford, London.
Brodsky, A. 1994. *The evolution of insect flight.* Oxford University Press, New York.
Dalton, S. 1975. *Borne on the wind*. Reader's Digest Press, New York.
Dudley, R. 2000. *The biomechanics of insect flight.* Princeton University Press, Princeton, NJ.
Kelly, Fred C. 1989. *The Wright brothers—A biography.* Dover Publications, Mineola, NY.
Wright, Orville. 1953. *How we invented the airplane*. Dover Publications, Mineola, NY.

Lest We Forget

Precambrian Pollen in Hakatai Shale, Grand Canyon, Arizona

Pollen grains and spores from flowering plants and other vascular plants have been found in samples of Precambrian Hakatai Shale from the Grand Canyon of Arizona. For a review of earlier works, consult Howe, Williams, Matzko, and Lammerts (1986). We collected and processed our samples with reasonable care to avoid contamination.

Out-of-order microfossils have been recovered by non-CRS workers also, and reported in other journals. But all such Precambrian pollen papers have been widely rejected, neglected, or reinterpreted. This is largely because they conflict with the stratigraphic notion that pollen-bearing plants did not evolve until hundreds of millions of years after Pre-Cambrian sediments had accumulated. Generally all such reports are "written off" as instances in which microfossils somehow entered the formations long after the strata formed.

This is the first in a series of "Lest We Forget" memos in which various non-*CRSQ* discoveries of Precambrian vascular plant microfossils will be reviewed. It is hoped by this that: (1) some other workers will be encouraged to initiate analyses of more Precambrian sediments for possible pollen content, (2) non-creationist workers will feel obliged to exercise less dogmatism in defense of their stratigraphic long ages, (3) creationists who establish origins models will realize and recognize that rocks called Precambrian by uniformitarians contain plant fossils (even pollen grains)—a notion that Froede has successfully defended (1999), and (4) it will be generally admitted that pollen grains have been repeatedly extracted from Precambrian strata. Such pollen grains are at variance with the gratuitous assumptions that there was a vast Precambrian era, devoid of vegetation, and that vascular plants did not exist when strata called "Precambrian" were deposited.

References

CRSQ: Creation Research Society Quarterly.)
Froede, C. R., Jr. 1999. Precambrian plant fossils and the Hakatai shale controversy. *CRSQ* 36:106–113.
Howe, G. F., E. L. Williams, G. T. Matzko, and W. E. Lammerts. 1986. Creation Research Society studies on Precambrian Pollen, Part I—A review. *CRSQ* 23:99–104.
Howe, G. F., E. L. Williams, G. T. Matzko, and W. E. Lammerts. 1988. Creation Research Society Studies on Precambrian Pollen, Part III: A pollen analysis of Hakatai shale and other Grand Canyon rocks. *CRSQ* 88: 173–182.

G. F. Howe
24635 Apple St.
Newhall, CA 91321-2614

The Saguaro National Park (east) Mylonites, Ultramylonites, and Cataclasites: Evidence in Support of the Genesis Flood

Carl R. Froede Jr., George F. Howe, and John R. Meyer*

Abstract

Saguaro National Park (east) is located on the eastern side of Tucson, Arizona. It encompasses both the Tanque Verde Ridge and most of the Rincon Mountains. The park affords a wonderful opportunity to examine a relatively untouched desert environment dominated by Saguaro cactus. We examined the western portion of the Park (defined by the area along Loop Drive) to better understand rocks defined as mylonites, ultramylonites, and cataclasites. In Arizona, these metamorphic rocks are found in the Basin and Range province and are associated with metamorphic core complex mountains. The Saguaro National Park (east) provides an excellent setting to examine these unique shear-altered rocks and understand the processes involved in their formation. Our preliminary assessment indicates that tectonic processes formed these rocks during the Genesis Flood.

Introduction

Saguaro National Park is composed of two distinct areas on opposing sides of Tucson, Arizona. This article limits discussion to that portion of Saguaro National Park on the eastern side of the city, identified as Saguaro National Park (east) (Figure 1). Both the Tanque Verde Ridge and most of the Rincon Mountains are contained within the park. While only a small area is accessible by automobile, foottrails cover much of the park. The visitor is presented with a beautiful desert environment dominated by the Saguaro cactus and a large variety of wildlife (Figure 2).

Geologists in the early 1970s realized that the rocks underlying this beautiful desert environment are somewhat unique. They are similar to shear-altered strata that occur in specific areas between southern British Columbia, Canada and northern Sonora, Mexico (Coney, 1980; Rehrig, 1986). These metamorphic rocks are identified as mylonites, ultramylonites, and cataclasites (see Appendix). Our preliminary investigation was limited to the area along the Loop Drive on the western side of the park (Figure 1). This area has previously been mapped and described by several geologists (Wright, 1978; Davis, 1980; 1987a; 1987b). Our findings are consistent with the tremendous geologic energy experienced by this region during the global Flood. Having studied granites and tectonic movement elsewhere (Froede, 1995a; 1998a) this region offered an interesting challenge to cast these strata into a young-Earth Flood framework.

Saguaro National Park (east)

Saguaro National Park (east) lies within the Basin and Range province in southern Arizona (Froede et al., 1997). According to Davis (1987a; 1987b) it is one of the finest locations in the world in which to recognize mylonites, ultramylonites, and cataclasites. These metamorphic rocks reflect the full range of shearing (i.e., ductile through brittle) thought necessary to explain the formation of these mylonitic rocks within the metamorphic core complex mountains (Davis, 1987a; 1987b). Examples of each rock type were readily apparent as we followed the Loop Drive around the western portion of the park (Figures 3 and 4). We were greatly aided by the Davis (1987a) field trip guide and supplemented it with additional stops and short hikes. Based on our fieldwork around Loop Drive, we offer an interpretation of the mylonites, ultramylonites, and cataclasites, including their formation and stratigraphic setting, within a Flood model.

Igneous and Metamorphic Rocks Within the Park

A variety of igneous and metamorphic rocks are found within the Saguaro National Park (east), including granite,

---

*Carl R. Froede Jr., B.S., P.G., 2895 Emerson Lake Drive, Snellville, GA 30078-6644; George F. Howe, Ph.D., 24635 Apple St., Newhall, CA 91321-2614; John R. Meyer, Ph.D., Director, Van Andel Creation Research Center, 6801 N. Highway 89, Chino Valley, AZ 86323

Received 7 June 2002. Revised 25 October 2002

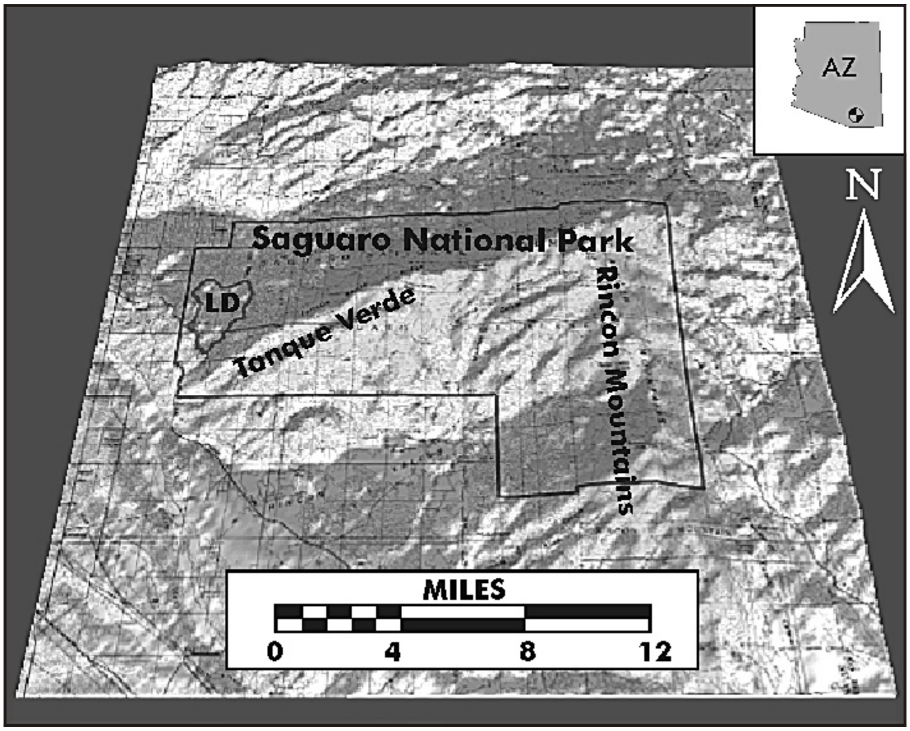

Figure 1. Topographic map showing the extent of Saguaro National Park (east). Note the Park encompasses the Tanque Verde Ridge and most of the Rincon Mountains. Our investigation was limited to areas adjacent to Loop Drive (LD). We found a variety of gneiss, mylonites, ultramylonites, and cataclasites consistent with the Davis (1987) field trip guide. Most of the Park lies within an area of mylonitization. Modified from the United States Geological Survey Tucson, Arizona Topographic Quadrangle using Maptech ©2001 software at 1X elevation.

gneiss, mylonized gneiss, ultramylonites, and cataclasites. Banks (1980, p. 185) describes the four principal rock units within the Park as:

> ...(1) generally light colored gneissic to mylonitic quartz monzonite and granite that intrude rocks as young as late or post-Mesozoic (Windy Point gneiss); (2) generally darker colored gneissic rocks derived mainly from Precambrian granitic rocks (granodiorite and quartz monzonite); and (3) black to tan mylonitic, blastomylonitic, and phyllonitic rocks also derived mainly from Precambrian Y granite rocks; and (4) undeformed granodioritic to granitic (mainly quartz monzonitic) rocks that likewise intrude rock as young as late or post-Mesozoic. The first three of these four main rock units are foliated, lineated, and intruded by abundant pegmatite dikes and sills, and together they comprise the bulk of the complex.

Keith et al. (1980, p.232), described the specific features and types of igneous and metamorphic rocks within the Park as:

> ...composed of muscovite-garnet-bearing granite. The granite commonly envelops a dark biotitic augen gneiss. Some parts of the granite have abundant pegmatite and alaskite. Both the granite and the dark augen gneiss exhibit the distinctive low-angle mylonitic foliation. This mylonitic gneiss complex is overlain to the northeast by metamorphosed and locally highly deformed younger Precambrian and Paleozoic rocks which become lower grade and less deformed up section. The western and southern boundaries of the mylonitic complex are—like those of the southern Santa Catalina forerange—highly jointed, brecciated, chloritized, and overlain by the Catalina fault, a dislocation surface which dips gently off the flanks of the range. The low-angle mylonitic fabric has been deformed into several broad west-southwest-plunging arches and one north-northwest-trending arch and is intruded by several north-northwest-striking undeformed dikes.

Mylonites, Ultramylonites, and Cataclasites

Mylonites, ultramylonites, and cataclasites found within the Park are metamorphic rocks that have been subjected to tremendous shear forces. The mylonitic gneiss exposed in the Park is so strongly layered that it resembles a thick stack of gently dipping sedimentary strata (Figure 4). However, upon closer inspection the variations in lithology are actually the result of penetrative foliation caused by shearing within the rock (Figures 5 and 6). On

Figure 2. Photograph of the Tanque Verde Ridge covered in desert vegetation dominated by the Saguaro cactus.

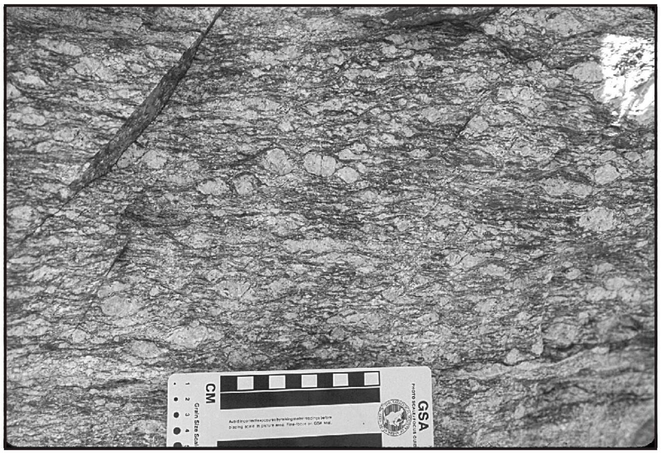

Figure 3. A typical augen gneiss. Note the large lenticular feldspar phenocrysts. Scale in centimeters.

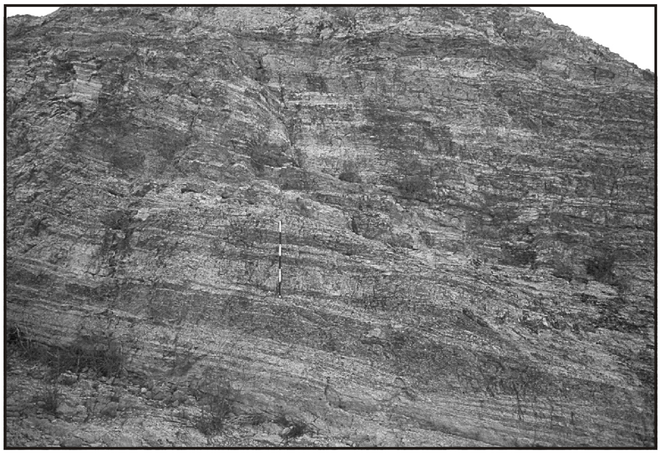

Figure 4. Photograph showing layered mylonitic gneiss. Scale in six-inch divisions.

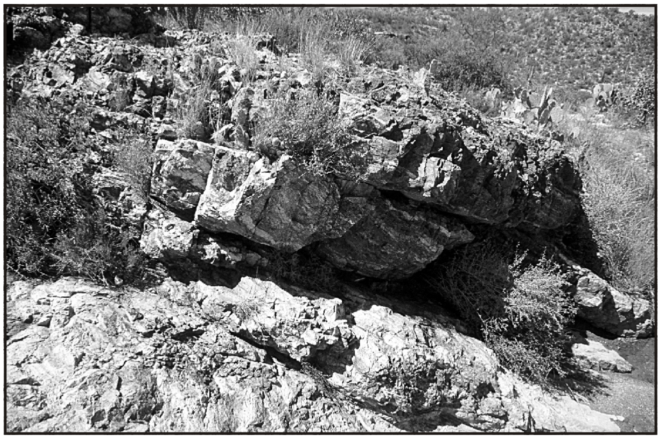

Figure 5. Several layers of mylonized gneiss with pronounced fault boundaries.

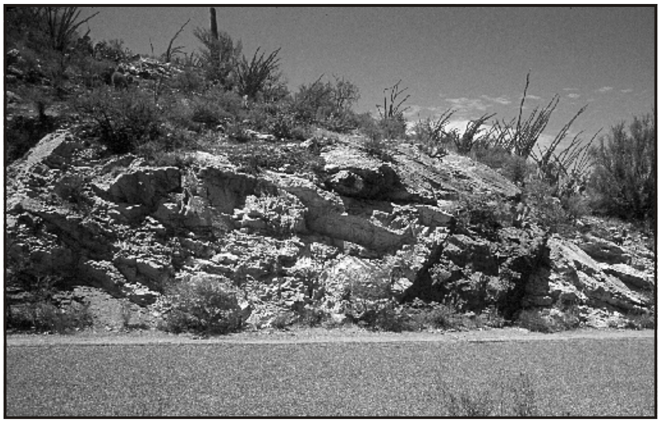

Figure 6. Photograph showing the layering of the mylonized gneiss. Note that a diabase dike is exposed on the right side of the exposure. These mafic features have largely been ignored in constructing models for metamorphic core complex mountains. They indicate a greater (and likely deeper) heat source associated with the granitic magmas. The six-inch unit scale is in front of the diabase dike.

average, the foliation gently dips 30° toward the Tucson basin. However, it is believed that the original foliation dip angle was as high as 45° (Davis, 1987a; 1987b). Mineral lineation of the quartz and quartz laminae found within the mylonites has a general orientation of N60°E–S60°W (Davis, 1987a; 1987b).

The origin of the shear force was likely due to the uplift and rotation of the original mountain-sized blocks caused by the injection of a leucogranitic melt into the overlying Precambrian granitic and metamorphic strata (Rehrig and Reynolds, 1980). Gravitational force acted on the uplifted block and created shear zones in its upper portion. The zone of mylonitization (i.e., shear zone) is believed to extend from the surface approximately 0.6 to 1.2 miles downward through the gneiss (Davis, 1987a). According to Rehrig and Reynolds (1980, p. 151):

> The mylonitic fabric formed by flattening perpendicular to foliation and extension parallel to the lineation. Strain ratios recorded in the mylonitic rocks of approximately 9:2:1 indicate that the amount of extension is significant.

The depth of uplift and cataclasis is believed to have originated from less than 1.8 to 3.7 miles beneath the former ground surface (Banks, 1980). However, Dickinson (1991) proposed a depth of mylonitic deformation in the range of 4.7 to 7.8 mi. Previously, depths were interpreted from 5 to 7.5 miles (Anderson et al., 1988), or perhaps even as deep as 9.3 miles (Anderson, 1988). Davis (1987a; 1987b) suggests that the mylonitization occurred from 6 to 7.2 miles below the surface. While Precambrian rocks are more deformed (ductilely and cataclastically) than the Tertiary-age gneiss, foliation and lineation in both were apparently formed in the same stress field (Banks, 1980).

Banks (1980) proposed that the tectonic event that formed the Rincon Mountains and Tanque Verde Ridge

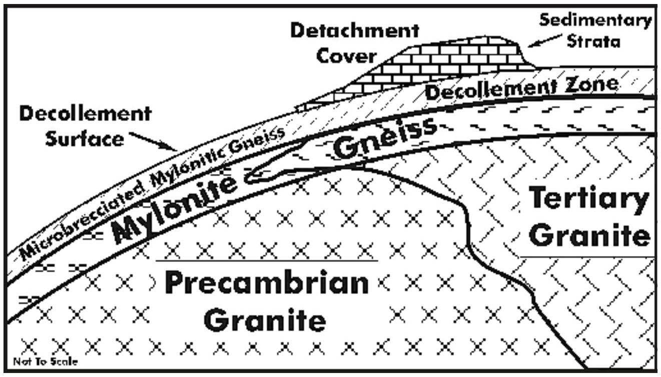

Figure 7. Diagram showing the conceptualized relationship between the various layers composing metamorphic core complex mountains—especially those found within the Saguaro National Park (east). Modified from Davis, 1987, Figure 3.

occurred during the middle Tertiary (20 to 30 m.y. B.P.), and Rehrig and Reynolds (1980) suggest a period from 25 to 15 m.y. B.P. associated with a period of widespread volcanism and plutonism outside the metamorphic core complex.

However, another interpretation has been offered by Keith et al. (1980). Using geochronologic methods, they identified three distinct suites of intrusions and accompanying deformations (Laramide, 75 to 64 m.y. B.P.; Eocene, 44 to 50 m.y. B.P.; and the middle Tertiary, 27 to 25 m.y. B.P.). A variety of age-dating methods were used to determine the ages of the various granitic, gneissic, and mylonitic rocks. This information coupled with trace-element analysis determined the lithologic and structural relationships of the rocks in an attempt to reconstruct the timing and events experienced by each intrusion and corresponding shear event. They proposed that:

> Much of the mylonitic (cataclastic) deformation of the plutonic rocks and recrystallization of the enclosing host rocks may be related to intrusion of the various plutons. At least three episodes of mylonitization (cataclasis) may be delineated by observing relations between mylonitic and nonmylonitic cross-cutting plutons (Keith et al., 1980, p. 218).

Anderson's (1988) work also supports three intrusive epochs involving 12 plutons and coeval mylonitization envisioned by Keith et al. (1980).

The timing and significance of the event(s) that resulted in the formation of the Tanque Verde Ridge and Rincon Mountains remain open to age-dating interpretation. However, geochronologic work conducted on rocks in the nearby Santa Catalina Mountains appears to support the injection of Laramide melts, but only two periods of mid-Tertiary mylonization (Force, 1997). Much remains unresolved in determining the timing and events that magmatic injection created in forming these sheared metamorphic rocks.

Metamorphic Core Complex Mountains

Most metamorphic core complexes are viewed as being derived from the middle crust and were eventually exposed by tectonic unroofing in an extensional setting (Krabbendam and Yardley, 2000). It has been proposed for the Tanque Verde Ridge and Rincon Mountains that approximately 20 to 30 m.y. ago there was *rapid* shedding of cover from the uplifting metamorphic core complex into adjacent basins (Banks, 1980; Drewes, 1977). Although several models have attempted to explain the formation of various metamorphic core complex mountains, none have proven successful on a broad scale.

According to Davis (1980), metamorphic core complex mountains can be defined by four distinct elements: (1) Igneous core, (2) Metamorphic carapace (i.e., decollement zone), (3) Decollement surface (i.e., detachment fault), and (4) Unmetamorphosed sedimentary cover (Figure 7). All four of these characteristics of metamorphic core complex mountains are found within the Saguaro National Park (east).

Core

The core is composed predominately of Precambrian quartz monzonite granite that has been penetrated in places by Tertiary quartz monzonite granite (Davis, 1987). Ductile normal faults are abundant in the core rocks and are always oriented perpendicular to mylonitic lineation (Davis, 1980). No matter the envisioned number of granitic magmatic penetrations, each event has resulted in some level of mylonitization. However, the last (mid-Tertiary) tectonic event resulted in the greatest level of intrusion by granitic melts along with the most significant levels of mylonitization.

Metamorphic Carapace

The strata within the metasedimentary carapace are metamorphosed to upper greenschist and amphibolite grade, are concordantly welded or plated to underlying crystalline rocks, and form a relatively thin sheet (Davis, 1980).

Davis (1987a; 1980) suggests that elevated fluid pressure is largely responsible for the zone of microbrecciation within the carapace:

> The nature of fracturing and the pervasive alteration records the role of fluids and fluid pressure in the fault-induced conversion of mylonites to microbreccias.

However, the extent that water played in the development of the detachment and emplacement of the core complex remains the subject of much controversy (Krabbendan and Yardley, 2000).

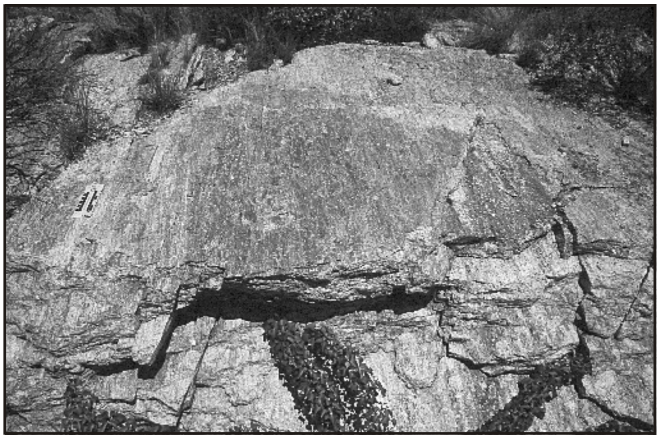

Figure 8. Photograph of the detachment (i.e., decollement) surface. Striations occur along the surface. The surface of the mylonized gneiss is also iron-stained, indicating the presence of water at the time of formation. Scale on left is in inches and centimeters.

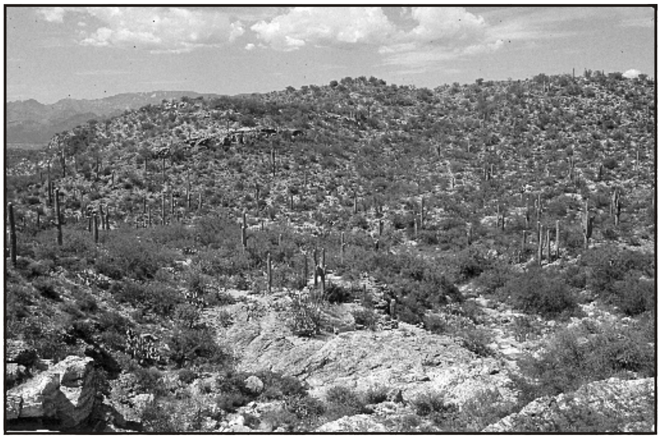

Figure 9. Large hill composed of sedimentary strata that has slumped westward toward the Tucson basin. The strata are contorted as a result of their lateral displacement.

A variety of shear related rocks can be found within the metamorphic carapace (i.e., decollement zone), including microbrecciated mylonitic gneiss, ultramylonites and cataclasites. The thickness of this carapace is likely a function of intense shear zone penetration as a result of the extensive lateral movement of the overlying rock.

Decollement

The boundary separating the mylonized rocks from unmetamorphosed strata is commonly a low-angle dislocation surface that develops within the gneiss (Rehrig and Reynolds, 1980). Movement within the fault plane then creates the metamorphic carapace. Striations along the top of the decollement surface confirm gravity-driven movement of the overlying sedimentary strata across this plane (Figure 8). According to Krabbendam and Yardley (2000, p. 670):

> The detachment fault and the underlying shear zone are the result of a progressive evolution. The deep and hot part of the shear zone (at a depth of 20 km [12.4 mi] or more) initially deforms in a very ductile manner, resulting in a wide zone of mylonitic gneiss. During further extension, the lower plate is pulled towards higher regions and brought against the cooler upper plate, Ductile deformation is localized in narrow shear zones, cross-cutting the mylonitic gneiss. Continuing extension cools the shear zone further and drags the rocks through the brittle-ductile transition; the ductile structures are locally overprinted by cataclasis and brecciation.

Sedimentary Cover

The sedimentary cover rocks have largely detached from the underlying basement rocks and moved under gravity toward the Tucson Basin (Figure 9). The fault contact between the bulk of the overlying sedimentary strata and the underlying mylonites is identified as the Santa Catalina fault. The trace of this fault extends from the southern end of the Rincon Mountains north and west across the Santa Catalina Mountains, a distance of 42 miles (Davis, 1987a). Most of the gravity-induced folding of the overlying sedimentary strata is associated with the final period of uplift associated with the Rincon Mountains (Davis, 1975).

According to Davis (1980, p.68), the sedimentary cover rocks have been affected by their lateral movement towards the Tucson Basin:

> Overturned asymmetric folds, detached isoclinal folds, and unbroken cascades of recumbent folds characterize the sheets of the Paleozoic and Mesozoic cover rocks. Most of the folds are transitional between ideal parallel and ideal similar folds and, thus, are characterized by some hinge-zone thickening. The scarcity of axial-plane cleavage, the abundance of bedding-plane cleavage, and the obvious influence of layering on the morphology of folds indicate that the folds evolved through slippage between layers and flow within layers.

Coney (1980) has suggested that water played a large role in the deformation and lateral transport of the overlying sedimentary strata.

The completeness of the sedimentary cover has also come into question. According to Davis (1980, p.68):

> Sedimentary rocks on the west side of the Rincon Mountains within the Saguaro National Monument (East) consist of limestone, dolomite, and shale of Permian age, as well as remnants of Mississippian(?), Pennsylvanian, and Cretaceous formations. Along the southeast flank of the Tanque Verde antiform, Cretaceous shale and limestone, with interbedded

siltstone, dolomite, and limestone conglomerate, lie directly on the decollement. The thickness of the sheet is less than 90 m (295 ft). Sedimentary rocks near Colossal Cave on the south side of the Rincon Mountains form a sheet approximately 150 m (492 ft) thick that rests on the decollement zone. The rocks consist of limestone interbedded shale and include formations of Cambrian through Permian age. At the southeasternmost corner of the Rincon Mountains, a 75 m (246 ft) sheet of Paleozoic rocks rests on the decollement zone. Although formations from Cambrian to Permian time are represented, the thickness of the sequence is less than 10% of the full Paleozoic section exposed in the Whetstone Mountains only 20 km (12.4 mi) south.

The individual sheets of Phanerozoic strata range from about 40 to 120 m (131 to 394 ft) in thickness. Strata within each sheet are generally unmetamorphosed, except near the base where limestones are commonly marbleized over thicknesses of 10 m (33 ft) or so.

A Possible Young-Earth Flood Interpretation

Our fieldwork is not the first investigation seeking to understand metamorphic core complexes within the framework of the global Flood of Genesis. An excellent detailed study of the detachment faulting in the northern Trigo Mountains (southwestern Arizona) was conducted by young-Earth creationist Scott Rugg (1986). He believed that the metamorphic core complex mountains that he investigated formed and developed during the global Flood. Our findings along Loop Drive are completely consistent with Rugg's (1986) interpretation. We believe that the Rincon Mountains and Tanque Verde Ridge were formed, uplifted/unroofed, and eroded during the Flood event when tremendous tectonic forces were still in effect (i.e., Middle Flood Event Timeframe; Froede, 1995b; 1998b).

Uniformitarian geoscientists suggest that abundant levels of water played an important part in the development of the mylonized gneiss. The sedimentary cover above the gneiss also indicates by its deformation that it was semi-lithified when it experienced tectonic uplift and lateral transport. Additionally, the fact that the regional Paleozoic and Mesozoic stratigraphic sections are thinner above the uplifted mylonite gneiss complex than "complete" sections found 12.4 miles to the south suggests that uplift of the metamorphic core complex mountains prevented the deposition of the uniformitarian-envisioned full stratigraphic sections.

We offer the following young-Earth interpretation that we believe is consistent with scripture, although other interpretations are possible. We view the Precambrian granites as likely formed during the Creation week. These granites were thousands of feet below the existing pre-Flood ground surface. We believe that the Flood eroded away any former (i.e., pre-Flood) sedimentary overburden above the igneous and metamorphic basement rocks. Turbulent Floodwater later deposited sediments and organic matter derived from a variety of source areas within this same area. Uplift of the Tanque Verde Ridge and Rincon Mountains occurred by granitic intrusion during the middle of the Flood. This created both erosional conditions and gravitational instability. The mountain-sized blocks rotated, causing the newly-deposited sedimentary layers to slide off the top of the basement surface toward the newly formed basin. Within the semi-molten area of the uplift, gravitational force created planes of weakness that we recognize today as normal faults within the granite. As the upper section of the uplifted basement rock gave way to gravitational sliding, it altered the vertical profile of the composition of the granite (from granite to gneiss, then to mylonitic gneiss, including ultramylonites and cataclasites). We see a transition from soft (at depth) to brittle (closer to the surface) deformation of the quartz monzonite granites along with the development of intense shear zones as we move up in section to the decollement surface. The tectonism coupled with the mylonitic strata is consistent with catastrophic processes that we would expect during the global Flood of Genesis.

Conclusion

The Loop Drive within Saguaro National Park (east) provides an excellent setting in which to observe mylonites, ultramylonites, and cataclasites in a beautiful desert setting. These rocks reflect the tremendous tectonic forces they experienced in Earth's past. Geologists continue to study these rocks in an effort to understand both how and why they formed. Found in the Basin and Range province, metamorphic core complex mountains reflect unique conditions and unusual tectonic forces.

We believe that the evidence for the abundance of water as a factor in both the mylonitization of the gneiss and the deformation of the overlying sedimentary cover strata points to the Flood. Additionally, the tremendous tectonism necessary to form the Tanque Verde Ridge and Rincon Mountains can best be understood as occurring during this same period of Earth history. All the evidence appears to support a rather brief period of time in which all of these events occurred.

Appendix

The following definitions may prove helpful in understanding the variety of mylonites found at Saguaro National Park (east). All definitions are from Jackson (1997) unless otherwise noted.

Cataclastic: Pertaining to the structure produced in a rock by the action of severe mechanical stress during dynamic metamorphism; characteristic features include the bending, breaking, and granulation of the minerals.

Cataclasite: A fine-grained, cohesive cataclastic rock, normally lacking a penetrative foliation or microfabric, formed during fault movement. The fracture of rock and mineral components is a significant factor in the generation of a cataclasite, and it may play a significant role in the continued deformation of the rock.

Cataclastic Flow: Flow involving intergranular fracturing and movement, i.e., mechanical displacement of particles relative to each other; a brittle flow mechanism.

Microbreccia: A well indurated, massive rock that has been crushed to a very fine grain size through cataclastic flow, commonly found within detachment faults.

Mylonite: ... a microbreccia with flow texture. It occurs in a variety of different forms, including protomylonite, ultramylonite, and blastomylonite. According to Yardley (2000), mylonites occur in zones of high strain or shear zones which vary in thickness from a few millimeters to several kilometers. The mylonitic textures result mainly from syntectonic recrystallization, in which large original grains become strained, leading to the nucleation of small unstrained grains that grow at the expense of the parent grain.

Mylonite Gneiss: A metamorphic rock that is intermediate in character between mylonite and schist. Felsic minerals show cataclastic phenomena with little or no recrystallization, and commonly occur as augen surrounded by and alternating with schistose streaks and lenticles of recrystallized mafic minerals.

Mylonitization: Deformation of a rock by extreme microbrecciation, due to mechanical forces applied in a definite direction, without noteworthy chemical reconstitution of granulated minerals. Characteristically, the mylonites thus produced have a flinty, banded, or streaked appearance, and undestroyed augen and lenses of the parent rock in a granulated matrix. Also spelled: mylonization.

Ultramylonite: An ultra-crushed variety of mylonite, in which primary structures and porphyroclasts have been obliterated so that the rock becomes homogeneous and dense, with little if any parallel structure.

Acknowledgments

The authors thank the many donors to the Creation Research Society Research Fund, interest from which financed a portion of these studies. We are grateful for the continued support we receive from our families. Dr. Steve Austin kindly provided a copy of the Scott Rugg thesis completed at the Institute for Creation Research. Dr. Emmett L. Williams and Mr. Jerry Akridge provided review and commented on a draft of this article. However, any mistakes that may remain are our own. We give our Creator God and His Son all the glory. Proverbs 3:5–6.

References

CRSQ: *Creation Research Society Quarterly*

Anderson, J.L. 1988. Core complexes of the Mojave-Sonoran desert; Conditions of plutonism, mylonitization, and decompression. In Ernst, W.G. (Editor). *Metamorphism and crustal evolution of the western United States*. pp. 502–525. Prentice-Hall, Englewood Cliffs, NJ.

Anderson, J.L., A.P. Barth, and E.D. Young. 1988. Mid-crustal Cretaceous roots of Cordilleran metamorphic core complexes. *Geology* 16:366–369.

Banks, N.G. 1980. Geology of a zone of metamorphic core complexes in southeastern Arizona. In Crittenden, M.D., Jr., P.J. Coney, and G.H. Davis (Editors). *Cordilleran metamorphic core complexes*. pp. 177–215. Geological Society of America Memoir 153. Boulder, CO.

Coney, P.J. 1980. Cordilleran metamorphic core complexes: An overview. In Crittenden, M.D., Jr., P.J. Coney, and G.H. Davis (Editors). *Cordilleran metamorphic core complexes*. pp. 7–31. Geological Society of America Memoir 153. Boulder, CO.

Davis, G.H. 1975. Gravity-induced folding off a gneiss dome complex, Rincon Mountains, Arizona. *Geological Society of America Bulletin* 86:979–990.

———. 1980. Structural characteristics of metamorphic core complexes, southern Arizona. In Crittenden, M.D., Jr., P.J. Coney, and G.H. Davis (Editors). *Cordilleran metamorphic core complexes*. pp. 35–77. Geological Society of America Memoir 153. Boulder, CO.

———. *1987a. Saguaro National Monument, Arizona: Outstanding display of the structural characteristics of metamorphic core complexes. In Hill, M.L. (Editor). Cordilleran Section of the Geological Society of America: Centennial field guide volume 1.* pp. 35–40. Geological Society of America, Boulder, CO.

———. 1987b. A shear-zone model for the structural evolution of metamorphic core complexes in southeastern Arizona. In Coward, M.P., J.F. Dewey, and P.L. Hancock (Editors). *Continental extensional tectonics*. pp. 247–266. Geological Society Special Publication No. 28. Blackwell Scientific. Boston, MA.

Drewes, H. 1977. *Geologic map of the Rincon Valley quadrangle, Pima County, Arizona*: U.S. Geological Survey Miscellaneous Investigations Map I-997, scale: 1: 48,000.

Force, E. R. 1997. *Geology and mineral resources of the Santa Catalina Mountains, southeastern Arizona: A cross-sectional approach*. Monographs in Mineral Resource Science No. 1. Center for Mineral Resources, Tucson, AZ.

Froede, C.R., Jr. 1995a. Stone Mountain, Georgia: A creation geologist's perspective. *CRSQ* 31:214–224.

———. 1995b. A proposal for a creationist geological timescale. *CRSQ* 32:90–94.

———. 1998a. Panola Mountain, Georgia: Exfoliation evidence in support of Flood exposure. *CRSQ* 35:41–44.

———.. 1998b. *Field studies in catastrophic geology*. Creation Research Society Books, St. Joseph, MO.

Froede, C.R., Jr., G.F. Howe, J.K. Reed, J.R. Meyer, and E.L. Williams. 1997. An overview of the geomorphology of Arizona (Van Andel Creation Research Center Report No. 1). *CRSQ* 34:68–74.

Jackson, J.A. (Editor). 1997. *Glossary of geology*. Fourth edition. American Geological Institute, Alexandria, VA.

Keith, S.B., S.J. Reynolds, P.E. Damon, M. Shafiqullah, D.E. Livingston, and P.D. Pushkar. 1980. Evidence for multiple intrusion and deformation within the Santa Catalina-Rincon-Tortolita crystalline complex, southeastern Arizona. In Crittenden, M.D., Jr., P.J. Coney, and G.H. Davis (Editors). *Cordilleran metamorphic core complexes*. pp. 217–257. Geological Society of America Memoir 153. Boulder, CO.

Krabbendam, M. And B.W.D. Yardley. 2000. Metamorphic core complex. In Hancock, P.L., and B.J. Skinner (Editors). *The Oxford companion to the Earth*. pp. 669–671. Oxford University Press. New York.

Rehrig, W.A. 1986. Processes of regional Tertiary extension in the western Cordillera: Insights from metamorphic core complexes. In Mayer, L. (Editor). *Extensional tectonics of the southwestern United States: A perspective on processes and kinematics*. pp. 97–122. Special Paper 208. Geological Society of America, Boulder, CO.

Rehrig, W.A., and S.J. Reynolds. 1980. Geologic and geochronologic reconnaissance of a northwest-trending zone of metamorphic core complexes in southern and western Arizona. In Crittenden, M.D., Jr., P.J. Coney, and G.H. Davis (Editors). *Cordilleran metamorphic core complexes*. pp. 131–157. Geological Society of America Memoir 153. Boulder, CO.

Rugg, S.H. 1986. *Detachment faulting in the northern Trigo Mountains, Arizona – A catastrophic interpretation of Tertiary geologic processes*. Institute for Creation Research, San Diego, CA. Unpublished Masters thesis.

United States Geological Survey. 1994. *Tucson, Arizona*. 30 X 60 Minute Series Topographic Quadrangle. Scale: 1:100,000.

Wright, C.C. 1978. *Folds in mylonite schist in the Rincon Mountains, Tucson, Arizona* [Senior thesis]. Carleton College, Northfield, MN.

Yardley, B.W.D. 2000. Mylonites. In Hancock, P.L., and B.J. Skinner (Editors). *The Oxford companion to the Earth*. pp. 719–720. Oxford University Press. New York.

◆

Lest We Forget

Precambrian Pollen in the Roraima Formation, British Guiana

Stainforth (1966) reported on researches conducted in 1963 by Dunsterville who collected samples of "shale-like" beds in the Roraima Formation of British Guiana. Later, palynologist Fournier, "... processed the samples and recovered well-preserved pollen spores... Subsequently, L. Nijssen and J. A. Sulek... processed other pieces [of shale-like material from the Roraima] and recovered identical plant microfossils" [brackets are mine], Stainforth (1966, p. 292).

"This discovery of pollen and spores in a formation of supposed Pre-Cambrian age was so remarkable that a reconnaissance expedition of qualified geologists was organized to verify the facts of the case" (p. 292). Note that it was only the discovery of pollen in the Roraima material that led to further research; had no pollen been found, it"s Precambrian "status" would probably have gone forever unchanged. This second research venture occurred in 1964 and included seven workers who repeated the collection and analysis.

> They confirmed the salient facts as recorded by Dunsterville, "New samples of unweathered rock were collected ... On their return to Caracas, the three palynologists made independent investigations of the new samples. Utmost care was taken to avoid any possibility of superficial contamination... [M]icrofossils of the same type as before were recovered" (p. 292).

Fournier concluded that the fossils Precambrian pollen was "... not the same... "as pollen from plants currently growing in that area (p. 293). Different workers concluded variously that the Roraima pollen was Tertitary, Eocene, Miocene, or even a "mixture of Mesozoic and Cenozoic elements... "(p. 293).

Stainforth explained that the findings were interpreted in two different ways: (1) some of the workers took the Precambrian "date" as accurate and concluded that "... the pollen (and spores) must have entered as secondary contaminants" [*sic*] p. 294 and (2) a second group gratuitously assumed that the Roraima formation must be changed from its Precambrian status because the pollen grains could not have entered into metamorphosed sediments from the outside [*sic*]. They were in fact saying that such *in situ* grains automatically proved that the Roraima is not Precambrian.

A third notion not entertained by Stainforth as a possibility is that flowering plants were present and shedding pollen when the Precambrian Roraima "times" were elapsing. A corollary of this third conclusion is that these particular, valid Precambrian sediments were laid down quite recently—not hundreds of millions of years ago.

Stainforth closed by stating: "... we offer no solution to the paradox and this presents... a highly intriguing geological problem" (p. 294).

Reference

Stainforth, R. M. 1966. Occurrence of pollen and spores in the Roraima Formation of Venezuela and British Guiana. *Nature* 210:292-294.

G. F. Howe
24635 Apple Street
Newhall, CA 91321-2614

Book Review

The Biblical Basis for Modern Science: The Revised and Updated Classic by Henry M. Morris

Master Books, Green Forest, AR. 2002, 474 pages, $13.99

In the introduction, Dr. Morris defends the scientific accuracy of the Bible. "Whenever a biblical passage deals either with a broad scientific principle or with some particular item of scientific data, it will inevitably be found on careful study to be fully accurate in its scientific insights" (p. 12). He maintains this uncompromising stance throughout the book. The four major sections of the book are

- Science and True Christianity: theology, cosmology, miracles and false science (theistic evolution and other compromising positions).
- The Physical Sciences: comogony, astronomy, thermodynamics, chemistry and physics.
- The Earth Sciences: geophysics, hydrology, meteorology, geology and paleontology.
- Life Sciences: biology, antropology, demography, linguistics and ethnology.

The author develops a logical and biblical framework for each topic he discusses. Likewise he presents the young earth position throughout the text: "If the evolutionary ages of geology cannot be fitted into the Genesis record, either before the six days of creation (gap theory) or during the six days (day-age theory), and if the Bible is indeed true and perspicuous, then where do we put the geological ages? The answer of course is that they don't need to be put anywhere, since they never existed in the first place" (p. 113).

He compares the creationist position vs. the evolutionist position on many subjects using scientific *facts* as a foundation for the creationist stance. The first and second laws of thermodynamics are explained in relation to the biblical worldview (pp. 171-200). Dr. Morris shows how these laws reinforce the creationist position as opposed to the evolutionist's unscientific approach to origins. The weaknesses and errors of historical geology are exposed and the author notes how the dynamic world-wide Noachian Deluge reshaped the surface of the earth (*The Genesis Flood*, coauthored by Dr. Morris, is an excellent scholarly introduction to this topic). Many articles and books in defense of the Flood have been inspired by the writings of Henry Morris who, fortunately, is an expert in hydraulics. Also he is not impressed with continental drift and plate tectonics. Morris suggests that it is premature for Christians to embrace the tenents of those speculations (p. 235).

The book contains six appendicies, chapter bibliographies for further reading, subject index, and scriptural index. I recommend this updated treatise to anyone interested in the origins debate. Reading this book may also allow Christians who have never before understood the significance of the origins controversy to realize that the creation position is the scientific one. May Dr. Morris have many more years to defend the faith!

Emmett L. Williams
P.O. Box 2006
Alpharetta, GA30023-2006

Flood Geology of the Crimean Peninsula
Part II: Conglomerates and Gravel Sandstones of the Demerdji Formation

Alexander V. Lalomov*

Abstract

Conglomerates and Sandstones of the Demerdji Formation[1] assigned to the Upper Jurassic comprise the third major stratigraphic sequence of the Crimean peninsula (southeast Europe, Black Sea coast). The basement of the Crimean sedimentary sequence consists of highly metamorphized rocks assigned to Precambrian and/or Paleozoic erathems. The second structural floor consists of folded sandstones and shales of Tavrick and Eksiordian Formations. The conglomerate contains exotic clasts with the probable source area located in the Ukrainian Crystalline Massif, up to 400 km to the north. This formation has numerous features that demonstrate its formation in a vigorous hydraulic regime. Hydraulic parameters derived from grain analysis suggest ranges of hydraulic conditions during the Flood, and erosion of the underlying flysch indicates a strong variation of hydraulic conditions during the main phase of the Flood. To the extent that these Crimean formations are typical of other geosynclinal settings, they can be used to interpret sedimentary sequences in other fold belts.

Introduction

This article is a continuation of long-term research of the sedimentary rocks of Crimea. In Part I of this series (Lalomov, 2001) the geology of the basement and lower strata of the Crimean sedimentary sequence was described. The basement consists of faulted, high-grade metamorphic shale and limestone, cut by diabase dikes. The shale and limestone are assigned to the Precambrian and Paleozoic erathems, respectively. Above the basement are sedimentary rocks of the Tavrick and Eksiordian Formations. The Tavrick Formation consists of flysch—rhythmically alternating sandstones, siltstones, and shales—assigned to the Triassic System. Overlying the Tavrick Formation without an angular unconformity, are the "flysch-like" shales and sandstones of the lower and middle Jurassic Eksiordian Formation. These rocks are interbedded with layers of gravel, tuff and volcanic rocks. Strata of both the Tavrick and Eksiordian Formations are folded.

Numerous features of these strata provide evidence of deposition in catastrophic conditions that would be expected in the Flood. In spite of this evidence, uniformitarian geologists of the former USSR consistently interpreted the Crimean sedimentary strata by means of gradualism. Lalomov (2001) reinterpreted the geology of Crimea in a creationist framework.

In this paper, the third Crimean sedimentary sequence is described and interpreted. It consists of conglomerate and gravel sandstones assigned to Upper Jurassic series

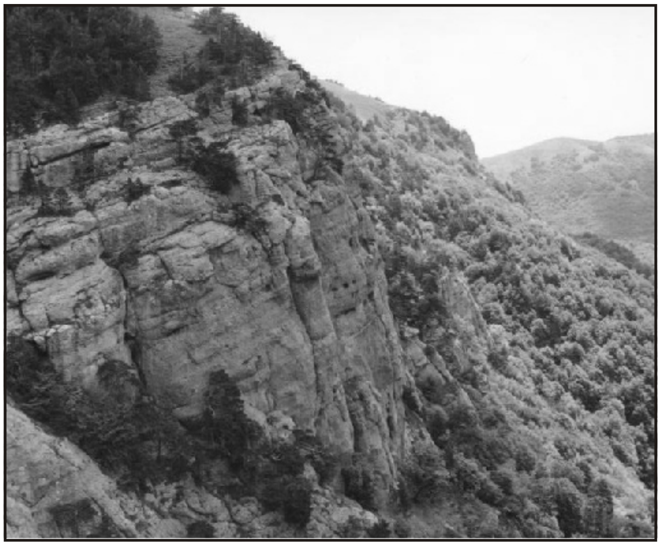

Figure 1. Conglomerate and Sandstone Formation (middle member), western slope of Demerdji Mountain.

---

*Dr. Alexander V. Lalomov, ARCTUR Geological Research Lab. (Moscow, Russia), alex.lalomov@mtu-net.ru http://www.creationism.org/arctur/

Received: 9 July 2002. Revised: 14 November 2002.

[1] The conglomerates and sandstones do not have a formal name. In the geological literature they are usually called "Upper Jurassic conglomerates" and "Upper Jurassic sandstones." Therefore I propose the name, Demerdji Formation, after the mountain where the formation has its most spectacular outcrop (Figure 1)

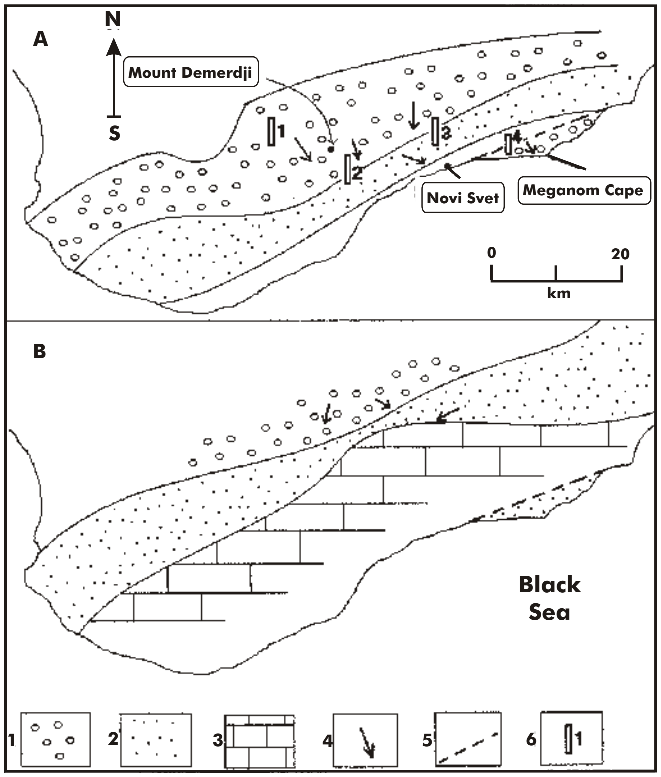

Figure 2. Schematic map of south part of Crimean Peninsula. Distribution of Conglomerate and Sandstone Formation (after Sidorenko, 1969, figure 24, with some changes and additions): A: Late Oxfordian-Early Kimeridgian stages of Upper Jurassic series; B:Tithonian stage of Upper Jurassic series. Legend: 1. Conglomerates; 2. Sandstones; 3. Limestones; 4. Direction of paleoflow; 5. Fault; 6. Researched exposures.

(Callovian and Oxfordian stages) that overlie the Tavrick and Eksiordian rocks across an angular unconformity. Although the erosion surface is mechanical; there is no intrinsic evidence of long periods interrupting sedimentation.

Rocks of the Demerdji Formation comprise the main ridge of the Crimean Mountains, reaching an elevation of up to 1500 meters above sea level. The formation extends approximately 80–100 km from west to east and up to 20 km from north to south. Its thickness reaches 750 m. It consists of pebbles, cobbles and boulders up to 1.0 m in diameter in a sand and muddy-sand matrix. Limestones assigned to the Kimeridgian and Titonian stages of the Upper Jurassic grade into (and sometimes juxtapose) the conglomerates and sandstones with some evidence of a paraconformity. Both the conglomerate and limestone strata are tilted.

Strata of the Demerdji Formation are well exposed on the southeastern slope of Crimean Ridge. They form prominent cliffs of the upper part of the slope. This formation contains many geological features that indicate that deposition in a vigorous current, and thus allows a determination of some hydraulic parameters of the Flood.

The Crimean mountain ridge is part of the Alpine fold system that extends from Western Europe to Middle Asia. The structure of the Crimean mountain area is typical of folded belts in the other regions. Therefore, the goals of this investigation include both a diluvial interpretation of the sedimentary sequence of the geosynclinal fold belt in Crimea, and the identification of criteria to extend that interpretation to similar sedimentary strata in the other regions.

In the description of the geological structure of Crimea, I use the terminology of the uniformitarian geological column, such as Triassic, Jurassic, Cretaceous, etc. Use of the column presupposes accurate biostratigraphic dating around the globe, which in turn demands the assumption of evolution (i.e., the same fossils are of the same age). Inasmuch as the temporal identify of such strata is questionable, absolute dating of the strata by use of the uniformitarian column is rejected. However, use of the terminology is employed for ease of reference.

Lithological Characteristics of the Demerdji Formation

Existing literature about the conglomerates is sparse and they have apparently not been studied before in detail. Therefore, I described the sequence of conglomerates and gravel sandstones on several outcrops and made a composite geological column for the Demerdji Formation.

The greatest thickness and the most complete sequence of the Demerdji Formation were observed on the western and southeastern slopes of Mt. Demerdji (Figure 2). The maximum visible thickness of the formation there is between 700 and 800 m. Both the underlying Tavrick Formation and overlying limestones are visible in these outcrops. Another exposure located northeast of Mt. Demerdji near Novi Svet village was studied. The upper section of the Demerdji Formation (about 300–400 m in thickness) was observed there. The easternmost significant outcrop of the Demerdji Formation is situated in the coastal cliff of Meganom cape. The thickness of the conglomerate strata there is up to 380 m.

The Demerdji Formation can be subdivided into three members (Figure 3). These members are not homogeneous, and the contacts are not always obvious; different lithologies exist within the main conglomerate. From the bottom to the top these members include:

- Matrix-supported conglomerate with mud-sand matrix,
- Clast-supported conglomerate with medium sorted sandy matrix, and
- Stratified gravel sandstone.

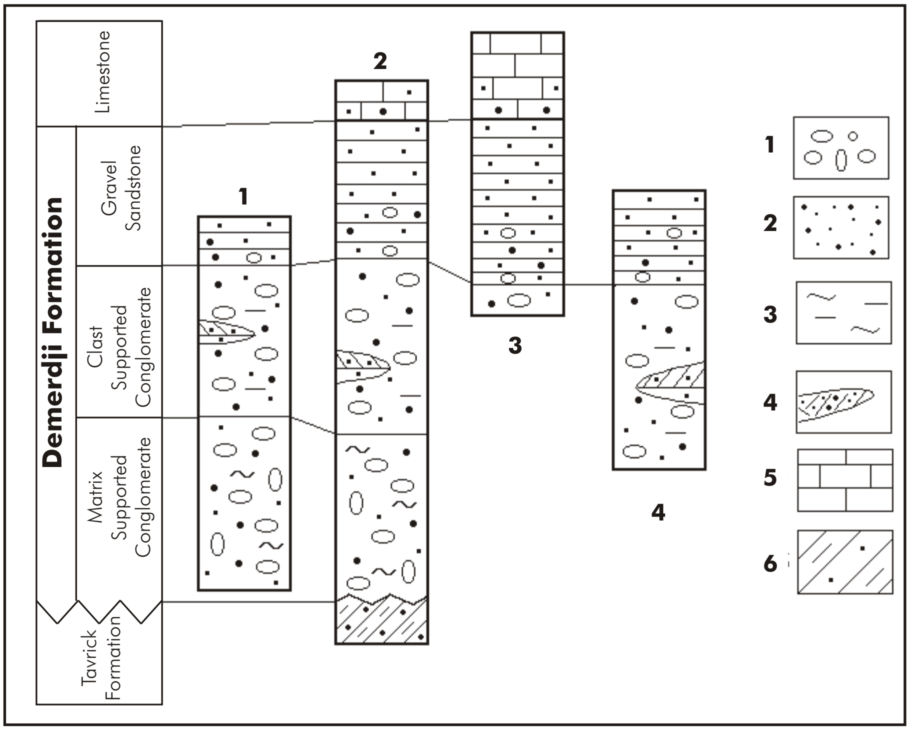

Figure 3. Correlation of local columns of Conglomerate and Sandstone Formation. Column 1: To the west from Mt. Demerdji; Column 2: To south-east from Mt. Demerdji; Column 3: North from Novi Svet village; Column 4: Coastal cliff of Meganom cape. Legend: 1. Pebbles, cobbles and boulders; 2. Heterogranular (varying particle size) sand; 3. Silt and clay; 4. Limestone; 5. Lenses of sandstone with cross-beds; 6. Turbidites of Tavrick Formation.

Matrix Supported Conglomerate

Rocks of this member are poorly-stratified conglomerate whose clasts are supported by a poorly sorted mud-sand matrix. The clast-supported fabric is not well developed. The matrix comprises approximately 40% of the total volume, and consists of heterogranular sand with silt and montmorillonite-hydromica clay (Sidorenko, 1969). The clay and silt content is up to 30–40% of the matrix. Clasts are pebble to cobble sized, subangular to subrounded, with occasional boulders up to 1.0 m in diameter (Figure 4). The clasts do not have a preferred orientation and graded bedding was not observed in this member. Occasional lenses of cross-bedded, coarse sand, 0.3–0.6 m thick and 3–8 m long occur in the upper part of the member.

The conglomerate clasts consist of fine to coarse sandstones and siltstones (58%), shale (12%) quartz (23%), and fine pebbly coarse sandstone (7%). The quartz gravel is mostly subangular. Sandstones, siltstones and shales are similar to the rocks that compose the underlying flysch strata. The underlying flysch also contains quartz veins, and that quartz is similar to the quartz gravel of the Demerdji Formation. However, the small (usually not more than 2–3 cm width), rare veins cannot explain the considerable amount of quartz in the conglomerates. Therefore, at least part of this quartz should be possibly considered exotic. The source of the fine pebbly sandstones is not clear. It may be from coarse-grained rocks of underlying formations (Tavrick or Eksiordian), or it may also be exotic.

The thickness of this member is approximately 300 m. Its lower contact is the eroded surface of the underlying Tavrick Formation and the contact is quite distinct . The erosion surface is planar to moderately undulate. The erosion surface does not provide evidence of a long period of interrupted sedimentation; rather it displays mechanical erosion only. The upper boundary of this member is not obvious; there is a gradational transition between it and the second member of the sequence.

Clast-Supported Conglomerate

Rocks of this member are clearly stratified. The alteration of sub-facies of clast-supported conglomerates and lenses of cross-stratified, coarse to medium-grained sandstones up to 0.5 m is common. Within the sandstone layers, a matrix-supported fabric is occasionally present. The matrix content in the conglomerate sub-facies is about 30%. Its pebbles and cobbles are mostly medium- to well-rounded. Maximum particle diameter is 0.4 m.

Clasts in this member are oriented parallel to bedding planes. Long axes have a west-southwest to east-northeast orientation. Graded bedding is present, clast sizes decrease

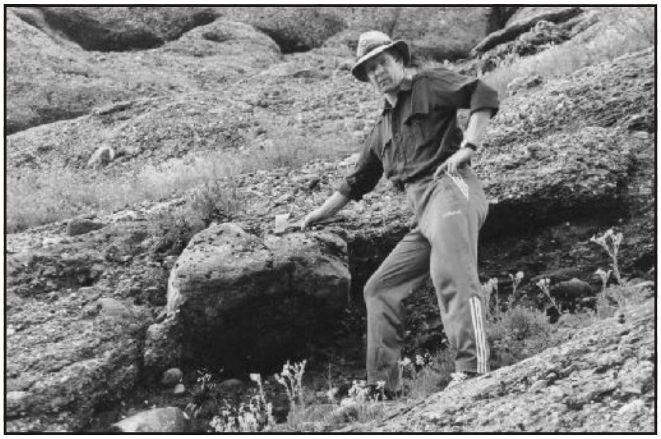

Figure 4. Matrix-Supported Conglomerate (lower member of the Formation) contains boulders up to one meter (photograph by E. Lalomova).

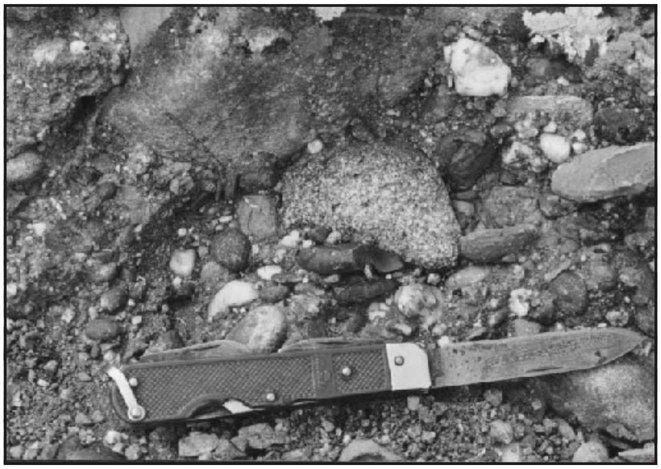

Figure 5. Exotic pebble of granite with iron oxide rind. Nearest location of granites is 400 km to the north.

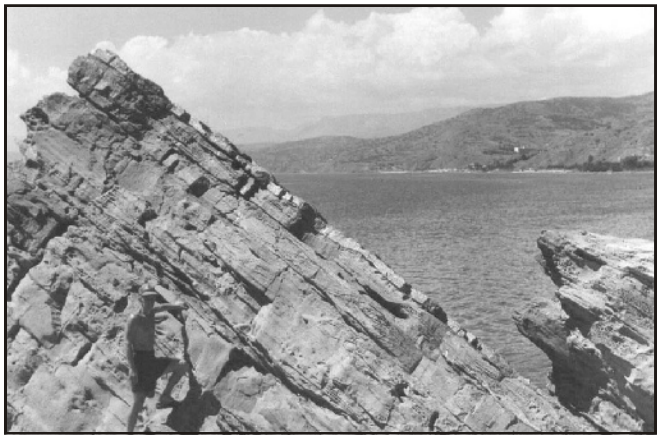

Figure 7. Gravel sandstone with strongly marked cross beds (photograph by E. Lalomova).

within the conglomerate sub-facies, and within the alternating conglomerate and sandstone sub-facies.

Finer-grained interbeds are coarse- to medium-grained sand. Strongly pronounced cross-bedding dips to the south-southeast. Thickness of the cross-bedded units ranges up to 1.5 m.

The petrography of the gravel is similar to the underlying member. The quartz gravel is much more rounded. Occasional (6 samples on four outcrops) biotite-hornblende-feldspar granite and granodiorite pebbles and cobbles are present in the conglomerate (Figure 5 and 6). These clasts are well-rounded with a fringe of iron oxide (weathering rinds). The granites and granodiorites are exotic in Crimean Peninsula. The nearest source of the granites is on the Ukrainian Crystalline Shield 400 km to the north (Dobrovolskaya and Snegireva, 1962; Dobrovolskaya, 1966), therefore it is likely that the material was transported that distance, if not farther.

A mathematical model of transportation of pebbles of marking rocks (Lalomov and Tabolitch, 1991; 1996) shows that with a considerable distance of transport (hundreds of kilometers), the content of the marking pebbles [Marking pebbles (or other size particles) mean clasts of the rocks that have limited in the space source area that allows determining transportation parameters such as a source of clastic material, direction of paleoflow and distance of transportation.] decreases by three orders of magnitude. Even if the marking clasts near the source are a considerable part of the load, as the flow withdraw from the source area the concentration decreases to 0.001–0.02% of the source content because of dilution of the marking clasts by fresh material and abrasion of the clasts. Thus, the low concentration of exotic clasts (along with high roundness and weathering rings) can be evidence of long transport (partially, at least) of exotic clasts.

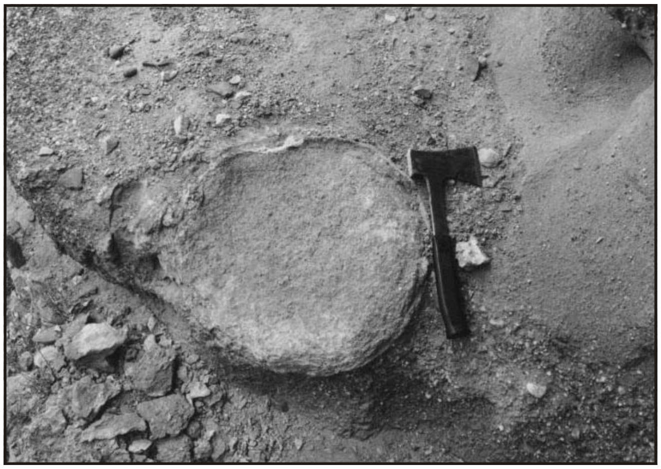

Figure 6. Exotic well-rounded boulder of granodiorite with weathering rind.

The thickness of the second member is about 250 m. The upper contact of the member is not obvious. It is distinguished by a decrease of size and content of gravel and by an increase in the thickness of the sandstone interbeds.

Stratified Gravel Sandstone

This member includes well- to poorly-stratified pebble sandstones. The content of the coarse clasts varies from 30–40% in the lower part of the member to 10–15% in the upper. The stratification is defined by the repetition of fine gravel beds and centimeters-thick, coarse- to medium-grained sand layers that are parallel or inclined at a low angle to the gravel beds. In the upper part of the member, the sandstone has a mostly massive fabric and has limestone cement.

Long axes of the pebbles are aligned parallel to bedding planes with an unclear orientation in plain view. The pebbles are smaller than those in the underlying member and are mostly well rounded. Rare cobbles up to 0.2 m were observed. The petrography of this gravel is similar to the underlying member. Cross beds were observed in the lower medium to coarse sand and fine gravel (Figure 6),

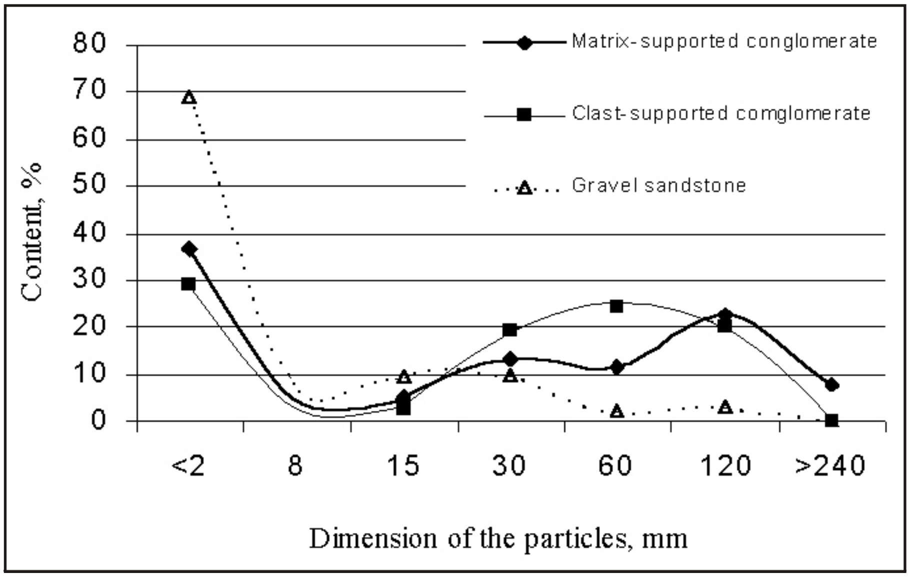

Figure 8. Granulometric composition diagram of Demerdji Formation.

dipping from southwest to east-southeast. Their thickness is up to 1.0 m.

This member is about 200 m thick. The upper contact is a thin gradational transition (not more than 3–5 m) or paraconformity with the overlying limestones. The lower limestone unit contains sand (up to 10%) and fine pebbles of sandstones, siltstones and quartz (not more than 5–10%).

All three members of the Demerdji Formation were evaluated by granulometric analysis. Five-meter sections athwart the bedding planes were measured. Along those sections, the matrix and clasts were measured, and the petrography of the clasts was described. The results of the particle-size analyses are displayed in Figure 8. All the strata had a bimodal distribution, indicating imperfect sorting. An increase in sorting was observed upward from the basal member to the upper.

In spite of local variations in the granulometric composition of the sediments, there is an obvious trend of fining of the sediments downstream to the flow and upward through the sequence. To the southeast, the conglomerate is juxtaposed with the gravel sandstone and even limestone (Tithonian stage of Upper Jurassic), providing a lateral transition of facies similar to what was seen upward through the section. Thus, this sequence represents a transgressive series, corresponding to the Law of Facies of Walther-Inostrantsev-Golovkinskii (Middleton, 1973).

Paleohydraulic conditions of Demerdji Formation sedimentation

The features of the Demerdji Formation provide the basis upon which to determine paleohydraulic conditions during the deposition of this phase of the Crimea sedimentary sequence. The limits of the range of velocity of the currents can be derived from estimates of the two factors of the depositional processes: erosion and transport.

Erosion Phase

Inasmuch as the conglomerate was deposited upon the erosional surface that forms the top of the Tavrick and Eksiordian formations, the initial velocity of the current must have exceeded the threshold velocity for erosion of the underlying flysch deposits. Austin (1994, p.106) determined the velocity of erosion of solid rock by cavitation during the Flood as 10 m (about 30 feet) per second. On the other hand, removing blocks of the bedrock by hydraulic plucking requires a much greater current velocity than that required for the movement of sedimentary clasts. Lebedev (1959) determined that the maximum non-erosive velocity for loose grounds (for boulders more than 0.5 m) varied from 5.4 to 6.2 m/s, depending on the average flow depth.

The “Upper Jurassic” conglomerates above the unconformity commonly rest directly on the folded strata of the Tavrick Formation; therefore it is reasonable that erosion of the Eksiordian and Tavrick Formations rocks reached a depth of 300–500 m (the thickness of the Eksiordian Formation). Under conditions of rapid erosion at Glen Canyon Dam, the velocity of erosion of solid sandstone bedrock reached 3 m (about 10 ft) per hour (Austin, 1994, pp. 106–107). Thus, the maximum expected erosion of the Tavrick and Eksiordian formations would have taken only a few days in a current moving with a speed of 6–10 m/s.

Transport Phase

Maximum clast size determines minimum current strength, therefore we can determine minimum current velocity from the relationship between the average diameter of the particles and the average critical velocity (Berthault, 2002). All observed methods (Hjulstrom, 1935; Neill, 1968; Van Rijn, 1984a;b; Maza and Flores, 1997) have determined the critical flow velocity for particles more than 0.5 m in diameter to be 4–7 m/s. Since boulders in the Demerdji Formation often exceed 0.5 m and sometimes reach 1 meter, the paleocurrent velocity during deposition of the matrix supported congomerate member was not less than 4 m/s. Minimum current velocities for the clast-supported conglomerate and stratified gravel sandstone members were 2 m/s and 1 m/s, respectively.

Gravel Sandstone layers grade into overlying limestones, perhaps across a paraconformity. Thus, as the transgression reached its maximum, the flow velocity had been decreasing from 10 m/s at the very beginning of this stage of hydrodynamic activity to near zero at the final stage during limestone deposition. Since the calculated settling velocity for flocculated lime-mud is approximately 0.15 to 0.6 mm/s (Julien, 1995, p. 78), the time of deposition of the limestone strata can be estimated at between 12 and 46 days in a basin 600 m deep.

These data strongly suggest that the Demerdji Formation represents a single transgressive series with an initial high-velocity paleocurrent that decreased to almost zero at the end of this sedimentary phase. The orientations of clasts and cross-bed dips indicates flow from north-northwest to south-southeast. During the final stage of deposition of the gravel sandstone member, the current direction fluctuated between northeast and northwest.

Although a precise duration of sedimentation has not been determined for the Demerdji Formation at this stage of research (a calculation will be performed later), the entire cycle of erosion, transport, and sedimentation of the Demerdji Formation should be measured in a few days, not in the millions of years estimated by uniformitarians for Upper Jurassic time.

Position of the Demerdji Formation in the Flood Model

The Demerdji Formation has many notable features that indicate the special significance of these strata in the structure of geosynclinal fold belts[2]. The Demerdji Formation overlies a flysch formation (turbidites) typical of geosynclines. The flysch strata of Crimea are commonly folded, with associated intrusions of dikes and volcanic activity. The beginning of Demerdji Formation deposition marked the conclusion of this deformation and igneous activity, and an increase in hydrodynamic energy that resulted in the erosion of the newly folded turbidite strata.

Apparently, the Demerdji Formation is an intermediate conglomerate that formed within the Flood sequence. I interpret the lower boundary of the Demerdji Formation as corresponding with what Davison (1995, p. 223) described as a boundary between megasequences that "indicate regionally- (or globally-) controlled tectonic or other activity which controlled sedimentation during the Flood." The Demerdji Formation possibly correlates with the RP-6 megasequences that Davison described for the Russian platform (Davison, 1995, table 3).

Reed *et al.*, (1996) recorded such an episode of increased hydrodynamic activity during the Flood in their geological energy versus time plot, segment 6 (Reed *et al*, 1996, Figure 1). They considered the increase to be a result of increasing energy from a mid-to-late-Flood tectonic readjustment.

A still more detailed interpretation for the stages of the Alpine geosyncline was provided by Baumgardner (1990). He explained the folding of flysch strata and hydraulic activity after the folding by the closing of the intra-Pangea basin between the African and Asian lithospheric plates, especially by "rapid movement of the Indian block to the northeast " (Baumgardner, 1990).

Folded and eroded turbidites overlain by conglomerates are typical of geosynclines. The conglomerates are usually described as "lower (marine) mollasse". According to the Geological Glossary (1960, p. 46):

> …it [the mollasse] is deposited in the marginal troughs of geosynclines in the main stage of orogeny [mountain-building stage] which follows powerful tectonic movements that cause the closing of geosyncline zones and the formation of mountain ridges with subsequent erosion. The mollasse consists mainly of products of denudation of the mountain massifs, but partly contains rocks transported from platform region" (translation from Russian by author).

Thus we see that mollasse formation is typical for folded belts, so it can be used as a characteristic of geosynclines for the correlation of megasequences.

Conclusion

Investigation of the Demerdji Formation demonstrates that these strata represent a single transgressive series that began with intense erosion of the underlying terrigenous-volcanic complex of the Tavrick and Eksiordian Formations. During the erosion, transport, and deposition of the Demerdji Formation, hydrodynamic energy decreased significantly and the sequence ended with the deposition of limestones.

Calculation of the paleohydraulic conditions for the deposition of the Demerdji Formation shows that conditions were unlike any modern episodes of catastrophic sedimentation. A preliminary estimate of the time of the complete sedimentary cycle (erosion – transport – sedimentation) is consistent with the Biblical Flood and contradicts the uniformitarian geological time-scale.

Finally, these Crimean strata are typical of geosynclinal systems, and can be used to correlate sedimentary sequences in other fold belts.

---

[2] *Geosyncline*: a pre-plate tectonic term describing one of the main elements of Earth's crust (the opposite to "platform") that is characterized by intensive processes of folding and by powerful volcanic and magmatic activity.

Acknowledgment

I thank Mr. Guy Berthault for support of this research and providing useful comments on the paper's content. I also thank the reviewers for editing of the earlier version of the paper and for the improvement of my English. I thank Dr John Reed for improvement of my English and useful recommendations. I also thank my wife Elena for her assistance in field research.

References

CRSQ: Creation Research Society Quarterly

Austin S.A. 1994 . *Grand Canyon: monument to catastrophe*. Institute for Creation Research, Santee, CA.

Baumgardner, J.R. 1990. 3-D finite simulation of the global tectonic changes accompanying Noah's Flood. In R.E.Walsh (editor). *Proceedings of the Second International Conference on Creationism,* Volume II, Creation Science Fellowship, Pittsburgh, PA.

Berthault, G., 2002. Analysis of main principles of stratigraphy on the basis of experimental data. Lithology and Mineral Resources . *Journal of Russian Academy of Science* 37(5):442–446.

Davison, G.E. 1995. The importance of unconformity-bounded sequences in Flood stratigraphy. *Creation Ex Nihilo Technical Journal* 9(2):223–243.

Dobrovolskaya, T.I. 1966. Paleogeograficheskie usloviya Krima vo vremya otlojeniya mezozoiskih konglomeratov (Paleogeographic environment in Crimea during deposition of Mesozoic conglomerates). pp. 76–83. *Proceedings of the Scientific Conference of Geological Departments of Lvov State University*, Lvov (Russian).

Dobrovolskaya, T.J. and O.V.Snegireva, 1962. Konglomerati Bitakskogo yarusa Krima (Conglomerates of Bitak assise of Crimea). *Proceedings of Academy of Science of USSR* 143(6):213–218 (Russian).

Hjulstrom F. 1935. The Morphological activity of rivers as illustrated by river Fyris. *Bulletin of the Geological Institute, Uppsala* 25:89–122.

Julien, P.Y. 1995. *Erosion and sedimentation* . Cambridge University Press, New York.

Krishtofovich A.N., editor. 1960. *Gosgeoltehizdat* (Geological glossary), volume 2. Moscow. (Russian).

Lalomov, A.V. 2001. Flood geology of the Crimean Peninsula, Part 1: Tavrick Formation. *CRSQ* 38(3):118–124.

Lalomov, A.V. and S.E. Tabolitch. 1991. Modelirovanie vdolberegovogo potoka nanosov I prognozirovanie pribrejno-morskih rossipei (Modeling of lateral coastal drift and prediction of coastal submarine placers). *Vestnic of Leningrad State University* 3(21):72–75 (Russian).

———. 1996. Catastrophism and modern geology: modeling of placer generation process . *CRSQ* 33(3):186–190.

Lebedev, V.V. 1959. *Gidrologiya I gidravlica v mostovom dorojnom stroitelstve* (Hydrology and hydraulic in bridge and road building). Gidrometeoizdat, Leningrad (Russian).

Maza A.J.A. and M.Garcia Flores. 1997. Vslocidades medias para el inicio del movimiento de particulas. *V Congreso Nacional de Hydraulica* . pp. 70–88. Guadalajara, Mexico.

Middleton G.V. 1973. Johannes Walther's law of the correlation of facies. *Geological Society of America Bulletin* 84:979–988.

Neill C.R. 1968. Note on initial movement of course uniform material. *Journal of Hydraulic Research* IAHR. 6(2):157–184.

Reed, J.K., C.R.Froede, Jr., and C.B. Bennett. 1996. The role of geologic energy in interpreting the stratigraphic record. *CRSQ* 33(2):97–101.

Sidorenko, A.V. (editor). 1969. *Geology of USSR*, volume VIII (Crimea) . Nauka, Moscow. (Russian).

Van Rijn L.C. 1984a. Sediment transport: Bed-Load transport Part I. *Journal on Hydraulic Engineering, ASCE* 10(11):1431–1456.

———. 1984b. Suspended load. *Journal on Hydraulic Engineering, ASCE* 10(11):1613–1641.

Lest We Forget

Precambrian Pollen in Russia

Evolutionary workers and some creationists too have been ignoring or rejecting the reports of vascular plant microfossils found in strata designated as "Cambrian" and "Precambrian" from many different areas of the world.

One such amazing report discusses "...microscopic vegetable remains from sedimentary rocks in Russia..., Poland, Czechoslovakia, Scotland, and many other countries in Europe and Asia" (*Science News,* 1962). The anonymous writer noted that "Tiny plant pollen grains have been found in rocks up to two billion years old." This had reference to a scientific report delivered by Dr. Sofija N. Naumova of the Geology Institute, Academy of Science, in Moscow as he spoke to the International Conference of Palynology, at the University of Arizona, Tucson.

> More than 650 species of spores and pollen... were described by the scientist. These included shreds of tissue and fragments of many algae... Remnants of primitive pine trees and seed-bearing plants were found during the study... the 32 complexes [of microfossils] can be clearly traced within eastern Europe and Siberia and, he added, can be successfully used for the correlation of the oldest sedimentary rocks on earth. (p. 281). We also found pollen and tracheids of land plants in Precambrian Hakatai shale at the Grand Canyon (Howe *et al.*, 1988).

It would be valuable for science if the published proceedings of Naumova's speeches at this conference could be located and reviewed. Attempts are currently underway to locate published accounts of Sofija N. Naumova's discovery of pollen and other vascular plant material in the Precambrian of many different countries. Any help in this regard will be appreciated and can be sent to address below.

It is true, as some workers assert that God *could* have created across vast periods of time if He had so chosen. But the issue is not "how *could* God have worked if He had wanted to" but "how *did* God create?" Neither the Bible (God's Word) nor science (human study of God's work) demands long ages in earth history.

References

Howe, G. F., E. L. Williams, G. T. Matzko, and E. E. Lammerts. 1988. Creation Research Society Studies on Precambrian pollen Part III: A pollen analysis of Jakatai shale and other Grand Canyon rocks. *Creation Research Society Quarterly* 24:182.

Unknown author. 1962. Pollen found in rock two billion years old. *Science Newsletter* 81:281.

G. F. Howe
24635 Apple Street
Newhall, CA 91321-261

Book Review

A *Beautiful Mind* by Sylvia Nasar
Simon and Schuster, New York, 1998. 461 pages, $16

This book, made into a popular movie, tells the life story of world-class mathematician John Nash. Born in 1928, Nash studied and taught at Pittsburgh's Carnegie Tech, Princeton University, and MIT. His insights and publications concerning game theory and economics were legendary. However, around age 30, Nash was struck with severe schizophrenia. This included dilusions, paranoia, personality change, and a near-homeless lifestyle. He wandered the Princeton campus for decades. Around 1990, at age 72, an unusual, spontaneous recovery occurred. Today John Nash functions normally, and he was awarded the 1994 Nobel Prize in economics for his earlier mathematical analysis.

Why include this book as a *CRSQ* review? John Nash is an example of a uniquely gifted person who has failed to honor his Creator. He came from a caring Episcopal family and attended Bible classes (p. 33). He was reared in Bluefield, Virginia in the Bible belt. Nash had a special interest in prophecy, and there were religious overtones throughout his 40-year sickness. He saw himself as "Esau, cast out" (p. 327). One can wish that Nash had found a positive mentor to follow during his early years. Instead he became vain, selfish, and socially snobbish. The book brings out a dark side of Nash that is missing in the movie. Nash had homosexual tendencies (p. 43) and a four-year relationship with a mistress (p. 174). He experienced divorce, and an illegitimate son later developed the same affliction of schizophrenia. This son also became involved with the radical *The Way* group.

If only Nash had developed a mature faith to bring structure to his life. Instead, however, he treated religion much too lightly, a weakness that is typical of many intellectuals today. On his Princeton application, just to raise eyebrows, Nash wrote that his religion was "Shinto." Much later, Nash claimed to "will his recovery" from schizophrenia by renouncing anything related to religion (p. 354). In his 1995 autobiography, Nash made no mention of his mother's faith or the biblical environment of his childhood. It appears that the gospel seed did not find fertile soil in the mind of Nash. He is honored as one of the great minds of our day, and is indeed highly gifted in mathematics. His knowledge is great, but thus far, there is a sad lack of wisdom concerning his Creator. It is not yet too late for John Nash to find peace of mind. Only the Creator can make everything beautiful in his time (Eccl. 3:11).

Don DeYoung
DBDeYoung@Grace.edu

La Brea Tar Pits: Evidence of a Catastrophic Flood

William Weston*

Abstract

According to the traditional view, the La Brea Tar Pits were pools of entrapment for unwary animals. This view fails to account for a variety of anomalies, including the disarticulation and intermingling of skeletal parts, the lack of teeth marks on herbivore bones, the absence of soft tissues, the inverse ratio of carnivores to herbivores, the numerical superiority of water beetles among insect species, and water saturation of wood debris. An alternative theory assuming a catastrophic flood is a better explanation of the data. This theory can apply to other late Pleistocene fossil sites, where similar anomalies occur. Fossil deposition by catastrophic flood seems to be global in scope. These considerations provide strong confirmation for the young Earth-Flood model of geologic history.

Introduction

This article is the third in a series featuring the La Brea Tar Pits as a by-product of a catastrophic flood. From the evidences examined here, the apparent hydraulic forces responsible for the features specific to this site are not simply due to localized disturbances. Instead, the evidence points to a worldwide phenomenon, namely, the Earth-covering Genesis Flood.

Disarticulated Insects in a Matrix of Soil and Tar

The following is from an article on insects:

> The turmoil in the tar has resulted in complete separation of the parts of the skeleton of most insects; only rarely are several parts connected. The eye sockets are empty, and mouthparts gone in all La Brea material (Pierce, 1947, p. 137).

Pierce provided no further elucidation. To learn more about what happened to these insects, a first-hand look at the entomological collection stored at the Page Museum of Hancock Park, site of the La Brea Tar Pits, was necessary. Closer examination indicated something other than turbulent tar was involved in the disarticulation process.

The study began with vial number 8819, which, according to the specimen catalog, contains six "cephalic capsules" of unidentified beetles from Pit 4. Each head is dark brown in color and about 4 mm in diameter. The corneas of the eyes are intact, but the antennae and mouthparts are gone. Examination through the foramen magna showed that the interiors are hollow. Gone are subcorneal parts of eyes, brains, esophagi, pharynges—everything. In other vials, some heads (Figures 1 and 2), abdomens, and thoraxes are hollow, while others contain a hard mixture of soil and tar. The infusion of soil and tar is the original condition of all specimens.

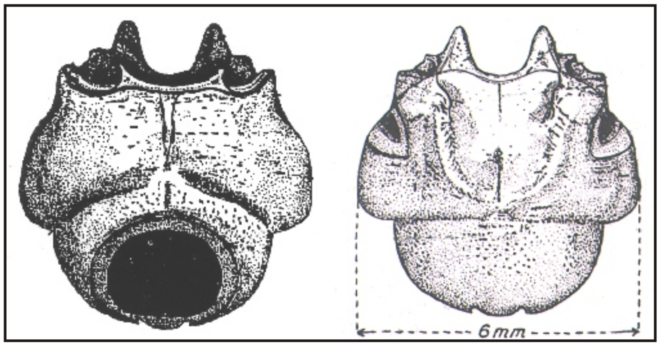

Figure 1. Cephalic capsule of *Nicrophorus*, a carrion beetle, showing the foramen magnum in the underside view on the left and the empty eye sockets in the dorsal view on the right (Pierce, 1949).

Cleaning the specimens can be a time-consuming and laborious process. A museum worker put chunks of asphalt into kerosene-filled jars for a week. Afterwards, the softened contents were placed on a tray containing benzene. Two more weeks of soaking elicited a loose assemblage of disarticulated heads, legs, wings, abdomens, thoraxes, and antennae. To clean out the body cavities, a worker placed specimens in xylene for another prolonged soaking. The next step was to use a fine needle to probe and excavate the inner matrix, cautiously and painstakingly to avoid damaging the specimen. Gentle brushing with a camel's hair brush removed the loosened debris (Pierce, 1946, pp. 116–117).

---

*10291 D'Este Dr., Anaheim, CA 92804, 714-774-2322
wsweston@juno.com

Received 2 November 2002. Revised 18 February 2003.

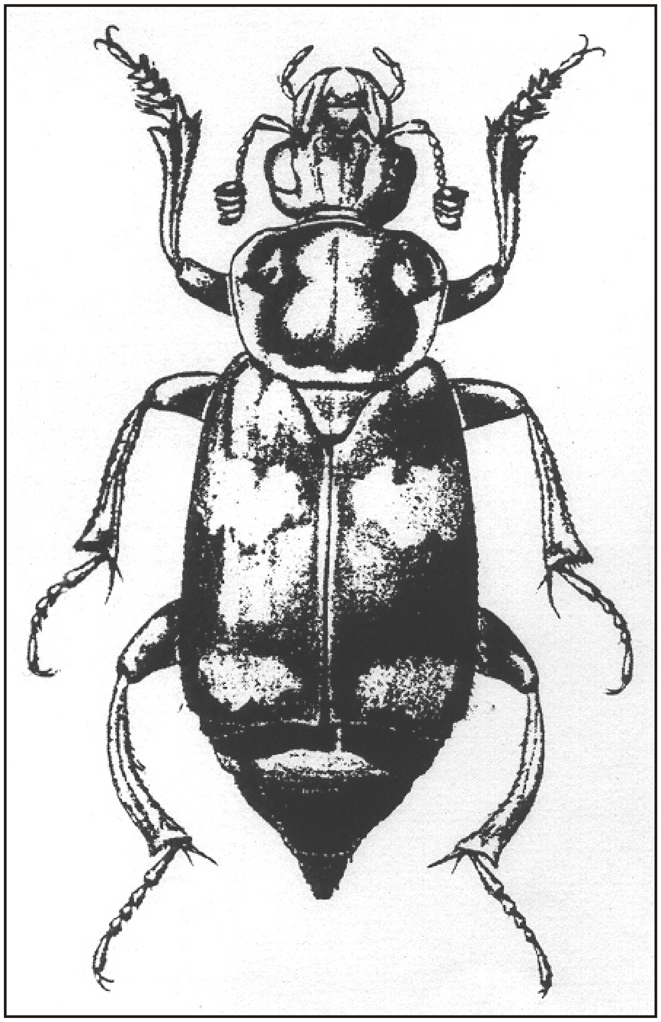

Figure 2. ***Nicrophorus*** **(Borror, de Long, and Triplehorn, 1981).**

At first, there was no way of determining whether any particular specimen was prehistoric or modern. To obtain datable samples, Pierce soaked a saber-toothed cat skull in benzene, which after several weeks liquefied the inner matrix. He then inserted a syringe into the foramen magnum and extracted the contents. Pierce was satisfied that this method yielded specimens from the Pleistocene age (Pierce, 1947, p.136).

Skull A-313 from Pit 13 is one of the 27 saber-toothed cat skulls selected for the retrieval of insect remains (Figure 3). A considerable amount of matrix material is still inside. Christopher Shaw, manager of the La Brea fossil collection at the Page Museum, demonstrated this fact to the present author by shaking the skull vigorously. This action produced the sound of particles buffeting the cranial walls. Like the beetle heads, skull A-313 was originally full of soil and tar. In view of these facts, some matters to consider are the dissolution of soft organic matter, the entrance of soil and tar into the empty cavities, and the relative duration of these processes.

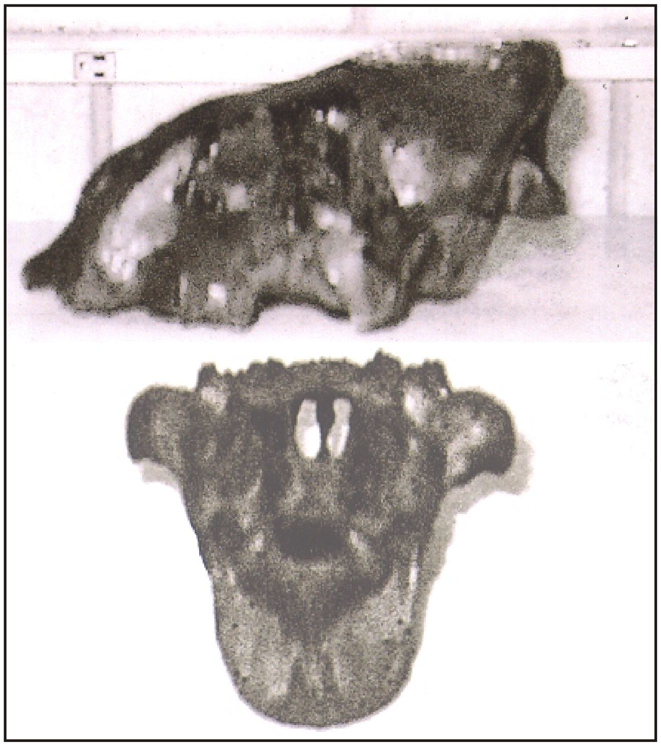

Figure 3. Lateral and underside views of saber-toothed cat skull A-313 found in Pit 13. The photograph of the underside view shows the round hole of the foramen magnum into which a syringe had been inserted. The missing large canines broke off sometime after the death of the animal.

The Disappearance of Soft Tissues

Non-skeletal components such as hair, skin, feathers, claw sheaths, scales, tendons, muscles, and internal organs have never been found at the La Brea site. The disappearance of this material has prompted some discussion regarding the causal factors.

Predators may be one explanation. A roving carnivore may have found a victim trapped in tar and proceeded to devour its flesh, leaving the skeletal parts to sink below the surface. As more such episodes occurred, bones accumulated as a growing mass at the bottom of the tar pools (Stock, 1929, p. 1, 4). While superficially persuasive, this explanation lacks conclusive evidence. Of the thousands of herbivore bones recovered, not one exhibits teeth marks. Signs of carnivore feeding, such as ragged edges on scapulas and mandibles or dentition patterns on the ends of limb bones and ribs, are absent. A single carnivore bone does, however, exhibit teeth marks (Figure 4). Etched on the surface of the tibia of a large lion are abrasion marks several centimeters in length, where teeth scraped against bone. The bone also has small abrasion grooves, about a millimeter in width and sometimes parallel. A hungry rodent with chisel-like teeth might have inflicted these

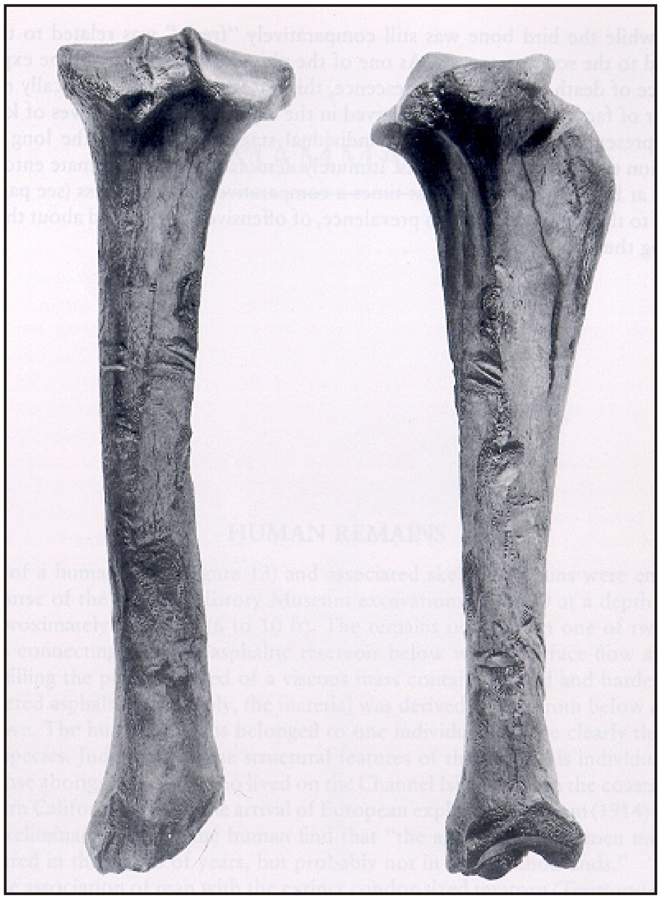

Figure 4. **Two views of the tibia of a large lion, *Panthera atrox*, showing teeth marks. (Stock, 1929).**

grooves (Stock, 1929, p. 4). Another possibility is that the lion suffered bone scratches during a desperate struggle with larger animals. In any case, there is little, if any, proof of predacious activity around the tar pits.

The effects of weather may be another cause. Under a hot sun, soft tissues liquefy and seep into the ground. Bones become rough, cracked, and scaly. During rainstorms, shallow floods move the bare skeletal parts to lower elevations, depositing some in tar pools (Stock, 1929, pp. 4–5). However, this is only a partial solution. Most of the bones recovered from the pits have a smooth, non-weathered appearance.

Shaw (1992, p. 43) suggested bacterial fermentation as an additional mechanism for tissue removal. Situated in an environmental niche that is normally toxic to other forms of life, microbes living in tar may have the capacity to consume dead organisms. However, studies of human cadavers and domestic animal carcasses show that many kinds of bacteria are involved in the decomposition process and interact in highly specific and complex ways. For example, *Proteus vulgaris* breaks down lysine into cadaverine, a foul-smelling substance. *Bacillus mycoides* and *Bacillus megatherium* transform proteins into ammonia. *Thiobacillus* oxidizes sulfur to produce sulfuric acid. Working in tandem with the bacteria are various kinds of insects. The cadaverine produced by *Proteus vulgaris* attracts flesh flies, which deposit larvae into the decaying carcass. These larvae secrete enzymes that further liquefy tissue and facilitate digestion for still more kinds of bacteria. Starting with a fresh body and ending with the desiccation of the skeleton, there are six stages of decay that extend over a period lasting six to twelve months (Pierce, 1949, pp. 55–58, citing Megnin). Although a complete description of the decay process is beyond the scope of this article, the details provided here show the participation of many types of organisms.

Petroleum-based solvents such as benzene, toluene, and xylene can also break down organic matter (Shaw, 1992, p. 43). In a purified state, these liquids dissolve rubber, gum, fat, resin, and other substances. However, as mentioned earlier, repeated immersions in solvent baths cause no discernible harm to insect remains. Oil and its specific ingredients may have no effect on dead tissue. Indeed, oil may act as a preservative. According to Greek historian Diodorus Siculus (circa 50 AD), solidified petroleum, or asphalt, was a necessary ingredient in embalming fluids:

> The largest portion of the asphalt derived from the Dead Sea is exported to Egypt, where among other uses, it is employed to mummify dead bodies; for without the mixture of this substance with other aromatics, it would be difficult for them to preserve these for a long time from the corruption to which they are liable (quoted in Abraham, 1960, p. 34).

Nissenbaum (1992, pp. 2, 5) confirmed the testimony of Diodorus and other ancient authorities. Additional evidence that oil is a preservative comes from the fossil deposits of Starunia, now located in the southwestern part of Ukraine. In 1907, when Starunia was under the control of Poland, pieces of woolly mammoth and woolly rhinoceros were found with intact skin, hair, and other soft tissues. One article mentioned the finding of a complete rhinoceros.

> Skin, hair, muscles and all other tissues were well preserved, owing to the sealing up of the monster in a kind of oily earth, which kept out the microorganisms of decay for many thousands of years (anonymous, 1930, p. 319).

Scientists studying the carcass concluded that the rhinoceros had died from drowning.

> It was observed that only the skin of the left side was damaged during the influx of sediment into the interior of the animal. It would thus appear that the animal had fallen victim to some type of catastrophe, such as the overflowing of a river, and the dead body was swept away by the surge of water.... On the dry areas of the rhino carcass was a crust of salt, even though, it must be concluded, the skin was soaked with an oily fluid.... This may incline us to assume

> that—along with fresh water—salt water was also present (Lengersdorf, 1934, p. 1).

Also in the Starunia deposit are various species of plants indigenous to arctic regions. This type of vegetation may indicate how the rhinoceros remained intact. Observations of animal carcasses in cold water show that the decomposition rate reaches a minimum. Additionally, decay gases do not accumulate. The waters of Lake Superior are very cold, and an old saying maintains that, "Lake Superior never gives up its dead" (Hapgood, 1958, p. 258). If the Starunia rhinoceros died in cold water, it might have sunk to the bottom, where sedimentation and oil seepages covered and preserved it.

Associated with the rhinoceros are insects. Unlike the fragmented remains found at Rancho La Brea, many Starunia insects are intact and so well preserved that scientists can study them "almost like Recent specimens" (Zeuner, 1958, p. 381). Some specimens are missing only an antenna or a few leg parts. The extracted genitalia of a number of male specimens of the *Helophorus* (a water beetle) have been useful in taxonomic studies. The quality of preservation even extends to colorations. Prolonged soakings in benzene release copious quantities of oil, and natural colors emerge (Angus, 1973, p. 301). In conclusion, oil does not degrade fleshly components but rather preserves them, even for thousands of years.

Auldaney's Post-Flood Catastrophism Theory

Auldaney (1994, pp. 25–35) proposed a catastrophic theory for Rancho La Brea's fossils. Using a variety of sources, he showed that some tar pit animals died at a another location. Floodwater transportation brought the carcasses to collection zones at lower elevations. Carnivores seeking easy meals scavenged among the remains. Auldaney suggested that earthquake tremors might have produced a massive upwelling of tar that surprised and trapped these scavengers. Unable to escape, the carnivores were drowned by new waves of floods. Supporting this view is a 300-square-meter slab of asphalt only 0.4 meters thick, full of bones, mostly of carnivores. Discovered in 1975 during the excavation of the foundation for the Page Museum, the base of the slab was in contact with silty clay.

According to Auldaney, the animals of Rancho La Brea died during the Tower of Babel period, when catastrophes such as huge volcanoes, torrential rains, and liquefaction of the landscape ravaged the world. While this theory fails to account for the disappearance of soft organic matter, Auldaney's insight regarding flood activity is worthy to consider. Water has the capacity to move debris, suspend huge quantities of sediment, and thus become a possible source for the soil found in skeletal cavities of insects and animals. Damage observed on insect remains may also be due to the effects of water.

> ...much of the material from the La Brea deposits appears badly abraded, probably by water transport from adjacent hills. Prominences such as the elytral humeri, the epipleural ridges and prosternal process are rounded or sometimes obliterated in such specimens, and cuticular sculpting and appearance are drastically altered (Doyen and Miller, 1980, p. 2).

Scratch marks on animal bones also indicate water transport over rough terrain. The motion of water may therefore produce a multitude of effects on fossil material.

The Effects of Water on an Insect Carcass

To test the effects of water on an insect, the present author put a live cockroach inside a 5-quart plastic bucket half-filled with water and placed it outdoors. The bucket had a lid punctured with air holes. The insect swam on the surface of the water but was dead the next day and continued to float. There were no changes until the third week, when the rear portion of the abdomen broke off and sank to the bottom. Later the rear portion returned to the surface. Gradually, over the next two months, antennae and leg segments detached and floated, along with the rest of the body. Bubbles formed around the openings of the main body and rear portion. Fluids seeped out and produced a pinkish film that clung to the bottom and sides of the bucket. By the fourth month another eruption occurred, leaving a gaping hole in the main portion. From this hole, more fluids and organs emerged. Later the head detached and floated. By the sixth month, the parts sunk to the bottom of the bucket.

Probably the buildup of gases associated with decomposition caused the ruptures and disintegration. The results of this exercise show that a prolonged period in water can dismember an insect, remove its inner organs, and scatter its remains. These effects are comparable to what appears in the insect material of Rancho La Brea.

The Prevalence of Aquatic Fauna at Pleistocene Fossil Sites

Nearly fifty families of the Insecta class appear in the La Brea collection with approximately 6300 identified remains. The most numerous family is Dytiscidae, a predacious diving beetle still found in ponds today (Figure 5). It has 2057 entries in the specimen catalogs, mainly of right and left elytra. Hydrophilidae, a family of scavenging water beetles, has 440 listings, mainly of elytra. Unlike the diving beetle, which is an active swimmer, the scavenging beetle

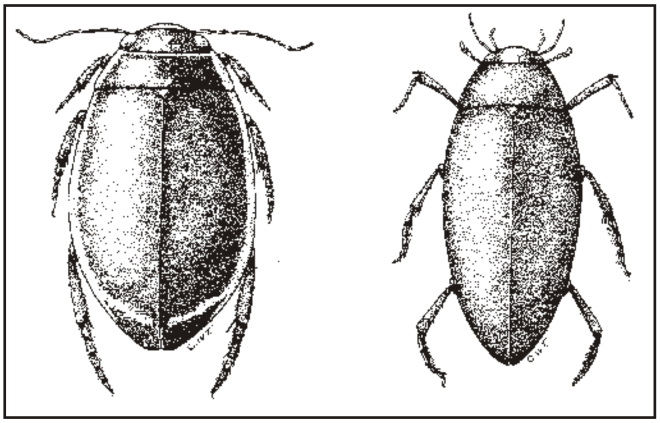

Figure 5. A diving beetle (family: Dytiscidae) is on the left. On the right is a scavenging beetle from the family Hydrophilidae. Both types are numerous at the La Brea Tar Pits (Borror, de Long, and Triplehorn, 1981).

prefers clinging to underwater plants or crawling along the bottoms of ponds.

The large numbers of water beetles at Rancho La Brea compares to that of fossil sites in Ukraine. Approximately 90% of the insects in Starunia and nearby Borislav are water beetles. Other species include montane varieties of the Orthoptera order. Angus (1973, p. 322) mentioned the “striking” fact that water beetles, typically inhabiting lowland areas, mix with insects living in mountainous habitats.

From a uniformitarian standpoint, it is unclear why non-aquatic species exist in much smaller numbers in the Pleistocene deposits of Ukraine and Southern California. Modern insects such as carrion eaters and those that are attracted to the tar itself often become entrapped (Miller, 1983, p. 94; Saylor, 1933, p. 182). Compounding the problem even more is the numerical superiority of water beetles at two other Pleistocene sites: the oil sands of Trinidad and the tar seeps of Talara, Peru (Blair, 1927, p. 138; Churcher, 1966, p. 989).

The predominance of water beetles has a counterpart among avian fossils. Waterbirds form a minority (about 8%) of the Rancholabrean avifauna, yet they exist in large numbers at other sites. At the tar seeps of Talara, Peru, there are about 9000 specimens of birds representing 89 non-passerine species and an indefinite number of passerine. The most numerous species is *Anas bahamenis*, a type of duck, which represents about 30% of the total number of bones (Campbell, 1979, p. 7). In a deposit of sand and pitch, 273 km north of Talara, at La Carolina, Ecuador, the *Anas bahamenis* is the second most abundant species of bird, behind *Aratinga roosevelti*, a type of parrot (Campbell, 1976, p. 157).

In the sedimentary deposits of San Miguel Island off the coast of Southern California are the remains of a small mammoth, as well as 41 species of birds. Over 75% of the avian fossils are waterbirds. At one locality, puffin bones literally form a pavement (Guthrie, 1992, p. 324).

On the island of Malta are various kinds of birds, but the most common are three species of swans and two species of cranes. These large birds associate with the bones of an extinct pygmy elephant (Northcote, 1992, p. 285).

In the silty accumulations of Fossil Lake in Oregon, bones of mammals admixed with bird bones. The largest numbers of avian specimens come from waterbirds, such as swans, ducks, and geese (Miller, 1912, p. 79).

At the tar seeps of McKittrick near Bakersfield, California, waterbirds comprise about 18% of the avifauna. Over half of these are ducks and geese (Miller, 1935, pp. 73–75).

The high concentration of water beetles and waterfowl at Pleistocene fossil sites may be an effect of the Genesis Flood. As creatures moved toward higher ground in their efforts to survive, the ones that can swim or float would have had an advantage over the strictly terrestrial types. The species living in the mountains would have had an advantage over the ones living on the plain. These considerations may explain why in Starunia lowland-dwelling water beetles mix with insects inhabiting the highlands. Eventually the Flood overwhelmed them all, but those that survived longer into the Flood period would be buried in the upper, or Pleistocene, levels of sedimentation while the ones that died earlier would be scattered in the lower strata.

The Predominance of Carnivores over Herbivores

Almost 90% of the mammal bones found in the La Brea Tar Pits are carnivores, wolves being the predominant type. Equivalent ratios occur with avian species. About 70% are flesh eaters, eagles being the most numerous. These unnatural ratios also occur at the tar seeps of McKittrick. Predatory land birds comprise 65% of the avifauna, eagles being the most common (Miller, 1935, pp. 74–75). Mammal carnivores, such as coyotes, wolves, lynxes, and saber-toothed cats, total about 55%. According to Schultz (1938, p. 129), the animals of McKittrick are probably not victims of entrapment:

> During late Pleistocene time sedimentation was active in the area, and as the oil reached the surface and spread out in sheets of *a fraction of an inch or so in thickness* it became intercalated with clay, sand, gravel, and wind-blown material.... At the McKittrick locality it seems improbable that the seeps could have had much effectiveness as traps; the principal function of oil seems to have been as a preservative. [emphasis added]

At the tar seeps of Talara, Peru, where “the main bone-bearing deposits occur as irregular lenses up to 6 feet thick and 20 to 30 feet in width” (Lemon and Churcher, 1961. p. 418), the bones of a variety of mammals appear, but the most common are carnivores. From a total number of

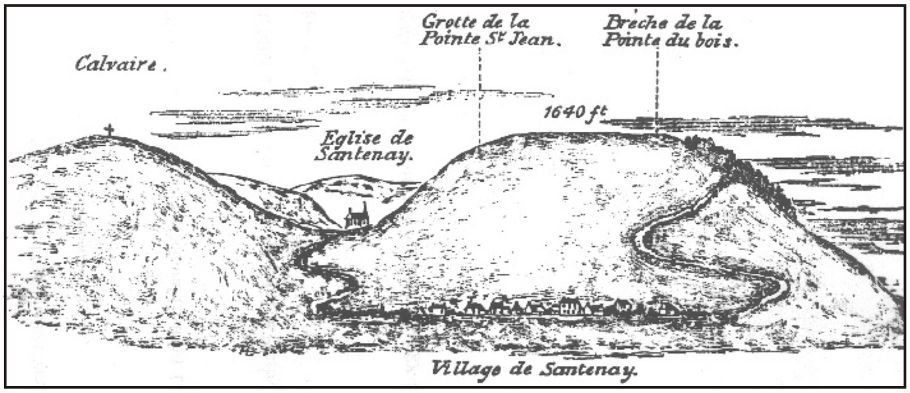
Grotte de la Pointe St Jean.
Breche de la Pointe du bois.
Calvaire.
1640 ft
Eglise de Santenay.
Village de Santenay.

Figure 6. Montagne de Santenay (Prestwich, 1894).

16,851 specimens, about 78% come from three kinds of carnivores: 7317 specimens of fox, 4032 of wolf, and 1866 of saber-toothed cat (Seymour, 2002).

A fossil site in France also has a large number of carnivores. Montagne de Santenay, an isolated hill rising 1030 feet above the surrounding plain, has steep sides and a nearly level platform on top (Figure 6). Close to the summit are limestone fissures filled with a hard breccia composed of broken bones, sharp-angled rock fragments, and yellowish-brown soil. The bones come from a variety of animals, including lion, fox, bear, horse, deer, ox, elephant, rhinoceros, but the most numerous come from wolves. In 1876, scientists belonging to the Geological Society of France saw the mixture of carnivores and herbivores but found no chew marks on the herbivore bones. They also observed that the breccia on top of the hill was a water deposit. The scientists concluded that a flood over a thousand feet high had arisen in the valley of the Saone River. Their discussion included various causes of the flood, such as excessive rainfall, the melting of snowfields, or the breaking of glacial dams, but each idea had significant drawbacks, and the group failed to reach a consensus (Prestwich, 1894, pp. 935–939).

One scientist of the group, Albert Gaudry, wrote a report on this hill. Joseph Prestwich (1812–1896), a prominent geologist in England (Figure 7), read this report and saw confirmation for a theory he was developing. From his own investigations of raised beaches, rubble drift, and bones in caves, Prestwich believed a gigantic flood of short duration submerged Western Europe near the end of the glacial, or Pleistocene, period.

> For a submergence of the character I have described would naturally drive the animals in the plains to seek refuge on the higher hills. Flying in terror and cowed by the common danger, the Carnivora and Herbivora alike sought refuge on the same spot, and alike suffered the same fate wherever the hill was isolated and not of a height sufficient to them to escape the advancing flood (Prestwich, 1894, p. 938).

According to Prestwich, dead animals formed a mat on the surface of the water. Eventually, body parts detached and fell irregularly on the submerged surfaces below, which accounts for the scattered condition of the bones.

The large number of wolf bones may indicate a struggle for the high ground. Wolves are generally stronger, more resourceful, and more socially organized than other animals, and they would have used these advantages aggressively to survive. The circumstances in France may have had an equivalent in California. Wolves fought with saber-toothed cats on the last remaining hills, while large predatory birds, such as eagles, hawks, and condors, fought in the last remaining trees. Although wolves and eagles were the winners in this struggle, in the end they lost, for the level of water rose above the hills.

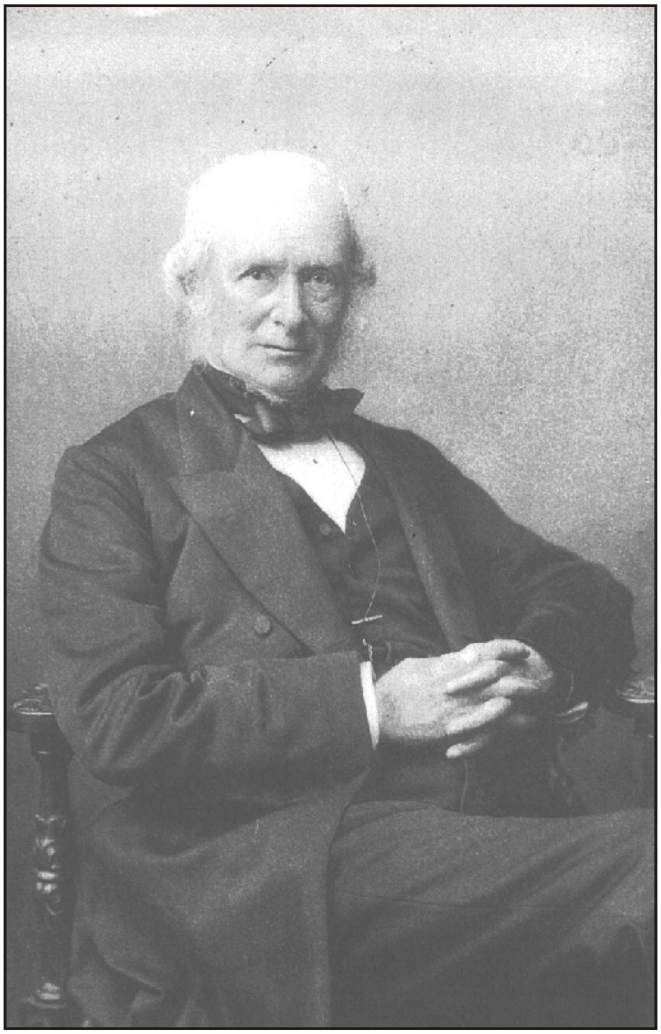

Figure 7. Joseph Prestwich (Prestwich, 1899).

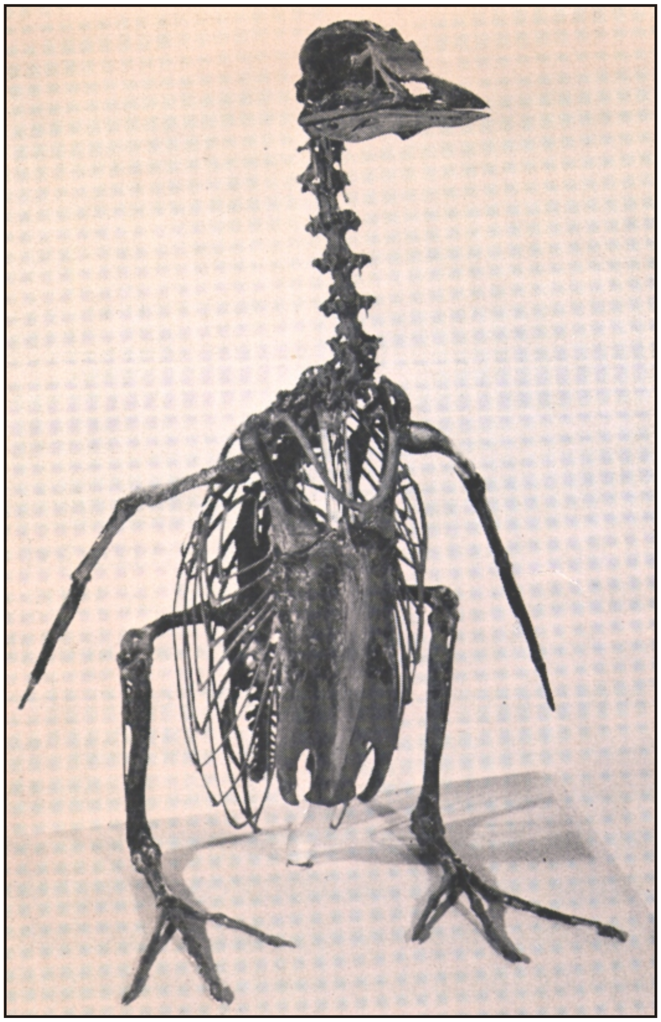

Figure 8. The *Mancalla*, a flightless auk from the Pliocene period of California (Howard, 1955).

Notwithstanding, hills which may have served as platforms of refuge in the vicinity of the La Brea Tar Pits do not seem to exist today. About three miles to the north of the pits are the Santa Monica Mountains, composed of volcanic rock that thrusted upward through deep sedimentary strata. These mountains probably formed as a late-Flood or post-Flood uplift and thus could not have been a converging area for frightened animals. Probably, the animals died elsewhere, and the tidal power of the Flood transported their remains over long distances. The victims buried in the tar pits may not even be native to California.

Diluvial Sorting and the Geologic Periods

The geologic strata found around the world have a false appearance of supporting the evolution of life-forms because invertebrates sometimes appear in lower strata designated as "older," while "younger" strata higher in the geologic column may contain vertebrate fossils. Creationists Whitcomb and Morris (1961, p. 275) said that vertebrates are in the higher levels of strata because they "possess much greater mobility." Typically, mammals and birds are in the top layers. Semimobile creatures, such as amphibians and reptiles, occur in middle layers, and the least mobile creatures, such as trilobites and brachiopods, occur in the deeper layers. Thus the geologic column can be reinterpreted along the following lines:

> (1) of increasing mobility and therefore increasing ability to postpone inundation; (2) of decreasing density and other hydrodynamic factors tending to promote earlier and deeper sedimentation, and (3) of increasing elevation of habitat and therefore time required for the Flood to attain stages sufficient to overtake them (Whitcomb and Morris, 1961, pp. 276).

Greater mobility is evident with wolves, which typically travel 30 miles a day, and occasionally go as far as 60 or more miles per day (Mech, pp. 50–53). This ability to run long distances may have favored them in the race from impending disaster. The same line of reasoning can also apply to birds. The variety and large numbers of birds at Pleistocene sites may be due to their ability to fly. Substantial numbers of waterbirds may be due to an additional ability to swim. Correspondingly, birds not favored with either or both of these abilities lie in the lower layers of geologic strata. Over 90% of the pre-Pleistocene avian fossils of California are those of the *Mancalla*, a flightless auk of the Pliocene (Figure 8). By 1970, close to 500 *Mancalla* bones had been found (Howard, 1955, pp. 13–19; Howard, 1970, p. 1).

Sparse numbers of birds in the lower layers of California strata are comparable to those of other parts of North America. Fragmentary remains from eight species are in Eocene layers, including owl, woodpecker, goose, flamingo, and two species of pheasant. The best-preserved is *Diatryma steini*, a large ostrichlike bird, and *Neocathartes grallator*, or Stilt Vulture. The latter had the capability of flight, yet its long legs made it more suited for ground travel (Howard, 1955, pp. 8–10; Swinton, 1965, pp. 41, 44–45, 48–49).

The general tendency toward limited volantation among birds buried in lower strata compares with the limited perambulation of lower-strata mammals and reptiles. Eocene river formations of Wyoming and Utah include such low-mobility types as turtles, crocodiles, rodents, rhinoceroses, and the giant titanotheres. So birds and animals least able to flee the onslaught of a flood are in lower sedimentation levels.

Speculations on the Order of Events at Rancho La Brea

When the Rancholabrean animals died in the Flood, internal gases of decay buoyed up their carcasses. With the onset of further decay, body parts detached and sank. Animals dying in the earlier stages of the Flood fell apart first, and their remains scattered in the lower levels of the building sedimentation below. Remains of animals dying in the latter stages of the Flood scattered in the upper layers.

After the continents upheaved, the surface landscape comprising Southern California was littered with bones. Strong currents of water retreating off the land in the late Flood period and during the fluvial activity of the post-Flood period transported and redistributed the bones to lower elevations. Some bones and soggy wood debris entered a small number of funnel-shaped pits, newly formed by natural gas blowouts caused by earthquake tremors. Oil from ruptured underground reservoirs seeped into these pits and flowed over the surrounding bone-strewn plain. This lake of oil thickened into tar, and its surface developed a hard crust, which sealed the pits and kept the matrix in a semiliquefied state. The slab of boniferous asphalt found in 1975 was part of this lake. Bones beyond the reach of the lake dissolved from decay and weathering.

Concluding Remarks

Part 1 of this series of articles presented features of the tar pits that challenge the entrapment theory: (1) broken, fragmented bones, chaotically disarranged; (2) carnivore predominance; (3) tight dimensions of some pits (five feet or less in diameter); (4) transient nature of tar pools, which form a surface crust after a short time; and (5) water-drenched logs and vegetation admixed with the bones. Part 2 showed how new data from Pit 91 led paleontologists to discard the idea of open pools of tar as animal traps and develop two alternatives: the tar puddle entrapment theory and a water transport theory, which incorporates a limited role for entrapments.

A water transport theory that does not include the entrapment concept may provide the most credible interpretation of the complex data of the asphalt fossil beds. Evidences presented in this article demonstrate how a catastrophic flood might have caused the results seen today at the La Brea Tar Pits. These evidences fit best within the context of the young Earth-Flood model of Earth history. Further creationist research at this site should show promise.

References:

Abraham, H. 1960. *Asphalts and allied substances: Their occurrence, modes of production, uses in the arts, and methods of testing*. D. Van Nostrand Company. Princeton, NJ.

Angus, R. B. 1973. Pleistocene *Helophorus* (Coleoptera, Hydrophilidae) from Borislav and Starunia in the Western Ukraine, with a reinterpretation of M. Lomnicki's species, description of a new Siberian species, and comparison with British Weichselian faunas. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences* 265:299–326.

Anonymous. 1930. Polish rhinoceros. *Science News-Letter* 27:319.

Auldaney, J. 1994. Catastrophic fluvial deposition at the asphalt seeps of Rancho La Brea, California. In Walsh, R. E. (editor), *Proceedings of the Third International Conference on Creationism*, technical symposium sessions. pp. 25–35. Creation Science Fellowship. Pittsburgh, PA.

Blair, K. G. 1927. Insect remains from oil sand in Trinidad. *Transactions of the Entomological Society of London* 75:137–141.

Borror, D. J., D. M. de Long, and C. A. Triplehorn. 1981. *An introduction to the study of insects*, fifth edition. CBS College Publishing, Philadelphia, PA.

Campbell, K. E. 1976. The late Pleistocene avifauna of La Carolina, Southwestern Ecuador. In Storrs L. Olson (editor), Collected papers in avian paleontology: honoring the 90th birthday of Alexander Wetmore. *Smithsonian contributions to paleontology* 27:155–168.

———. 1979. The non-passerine avifauna of the Talara tar seeps, northwestern Peru. *Royal Ontario Museum, Life Sciences Contribution* 118:1–203.

Churcher, C. S. 1966. The insect fauna from the Talara tar-seeps, Peru. *Canadian Journal of Zoology* 44:985–993.

Doyen, J. T. and S. F. Miller. 1980. Review of Pleistocene darkling ground beetles of the California asphalt deposits (Coleoptera: Tenebrionidae: Zopheridae). *Pan-Pacific Entomology* 56(1):1–10.

Guthrie, D. A. 1992. A late Pleistocene avifauna from San Miguel Island, California. *Papers in avian paleontology: honoring Pierce Brodkorb. Proceedings of the II International Symposium of the Society of Avian Paleontology and Evolution*, Campbell, K E. (editor), pp. 319–327. Natural History Museum of Los Angeles, CA.

Hapgood, C. 1970. *The path of the Pole*. Chilton Book Co. Philadelphia, PA.

Howard, H. 1955. *Fossil birds with especial reference to the birds of Rancho La Brea*. Los Angeles County Museum.

———. 1970. A review of the extinct genus, *Mancalla*. *Contributions in Science* 203:1–12. Los Angeles County Museum.

Lemon, R. R. H. and C. S. Churcher. 1961. Pleistocene geology and paleontology of the Talara region, northwest Peru. *American Journal of Science* 259:410–429.

Lengersdorf, F. 1934. Dipteren aus den diluvialen Schichten von Starunia. *Starunia* 4:1–8.

Mech, L. D. 1966. *The wolves of Isle Royale*. U.S. Government Printing Office, Washington.

Miller, L. H. 1912. Contributions to avian paleontology from the Pacific coast of North America. *University of California Publications in Geology* 7:61–115.

———. 1935. A second avifauna from the McKittrick Pleistocene. *The Condor* 37:73–79.

Miller, S. E. 1983. Late Quaternary insects of Rancho La Brea and McKittrick, California. *Quaternary Research* 20:90–104.

Nissenbaum, A. 1992. Molecular archaeology: Organic chemistry of Egyptian mummies. *Journal of Archaeology* 19:1–6.

Northcote, E. M. 1992. Swans (Cygnus) and cranes (Grus) from the Maltese Pleistocene. *Papers in avian paleontology: honoring Pierce Brodkorb. Proceedings of the II International Symposium of the Society of Avian Paleontology and Evolution*, Campbell, K E. (editor), pp. 285–292. Natural History Museum of Los Angeles, CA.

Pierce, W. D. 1946. Fossil arthropods of California: 10. Exploring the minute world of the California asphalt deposits. *Bulletin of Southern California Academy of Sciences* 45:113–118.

———. 1947. Fossil arthropods of California: 13. A progress report on the Rancho La Brea asphaltum studies. *Bulletin of Southern California Academy of Sciences* 46: 136–138.

———. 1949. Fossil arthropods of California: 17. The Silphid burying beetles in the asphalt deposits. *Bulletin of Southern California Academy of Sciences* 48:55–70.

Prestwich, G. 1899. *The life and letters of Sir Joseph Prestwich.* William Blackwood and Sons, London.

Prestwich, J. B. 1894. On the evidence of a submergence of Western Europe, and of the Mediterranean coasts, at the close of the Glacial or so-called Post-glacial Period, and immediately preceding the Neolithic or Recent Period. *Philosophical Transactions of the Royal Society of London, 1893, Series* A, pp. 903–984.

Saylor, L. W. 1933. Attraction of beetles to tar. *Pan-Pacific Entomology* 9:182.

Schultz, J. R. 1938. A late Quaternary mammal fauna from the tar seeps of McKittrick, California. *Carnegie Institute of Washington Publication* 487, pp. 118–161.

Seymour, K. Assistant Curator at the Royal Ontario Museum. 2002. Personal communication.

Shaw, C. 1992. How the fossils were preserved. *Terra* 31(1):43.

Stock, C. 1929. Significance of abraded and weathered mammalian remains from Rancho La Brea. *Bulletin of Southern California Academy of Sciences* 28:1–5.

Swinton, W. E. 1965. *Fossil birds.* British Museum (Natural History). London.

Whitcomb, J. C. and H. M. Morris. 1961. *The Genesis Flood.* The Presbyterian and Reformed Publishing Co., Philadelphia, PA.

Zeuner, F. E. 1958. *Dating the past: An introduction to geochronology.* Meuthen & Co. London.

In the Beginning God

Thomas G. Barnes

There is no means by which science, per se, can determine with certainty how matter and energy or living things came about. From a strictly scientific point of view their beginnings are indeterminate. This *principle of indeterminate inception* is comparable to the uncertainty principle which plays such a fundamental role in quantum mechanics. It points out the futility of scientific efforts to provide an absolute solution to the problem of the beginnings.

The principle of indeterminate inception rests on the premise that the beginnings must have taken place outside the domain of the two most inclusive laws of science, namely the first and second laws of thermodynamics, because those laws renounce anything older than a full-blown system and its irreversible transitions toward a lower-ordered system.

There are great weaknesses in the uniformitarian-evolutionary theories. They cannot give a positive insight into the beginnings because this is indeterminate scientifically. They run counter to the greatest laws of science. The experimental method cannot be employed to check those theories. The theories themselves require too many amendments to check with known scientific data.

The scientist who is willing to accept the Scriptures at face value is then able to discard the uniformitarian-evolutionary concepts and finds that science and Scripture blend into a harmonious relationship that opens new avenues to both life and science.

From: Barnes, Thomas G. 1964. Superiority of scientific approach that accepts its limitations and makes use of the scripture. *CRSQ* 1:56. This volume and all others of the *CRSQ* are now available in printed and electronic form. An order form is at the end of this issue.

Helioseismology: Implications for the Standard Solar Model

Jonathan F. Henry*

Abstract

Helioseismology, the study of solar vibrations, has revealed a higher degree of homogeneity in the sun than is commonly assumed. This is contrary to the standard solar model (SSM), in which the sun is assumed to be segregated into a core region and radiative and convective regions which do not experience significant mixing with the core. Furthermore, a degree of solar homogeneity and concomitant mixing implies a lower core temperature than is typically assumed, which in turn means that significant helium production may not be occurring in the sun. Deuterium produced via hydrogen fusion therefore may not be consumed in producing helium. The deuterium abundance of the interstellar medium appears to be consistent with the possibility that deuterium is not consumed in the sun via helium production, but escapes into interplanetary space due to the sun's homogeneity.

Introduction

In the SSM, nuclear burning of hydrogen into helium is supposed to occur in the solar core. Neutrinos should also be produced as helium forms, but until 2001, several decades of solar neutrino detection efforts had consistently shown that neutrinos are not produced at the rate predicted by the SSM. This shortage was termed the "solar neutrino problem" (SNP). The SNP implied that the suite of nuclear reactions assumed in the SSM may not be occurring, with deuterium production from hydrogen fusion being possibly the only significant nuclear reaction in the sun. The core temperature implied by this reaction is on the order of 1 million K or less, in contrast to the 15 million K commonly assumed. In 2001, results from the Sudbury Neutrino Observatory (SNO) resolved the SNP by reportedly detecting the "missing" neutrinos. Since the announcement of the SNO results, the claim has been publicized that the SNP has been "cleared up" and that the SSM has been confirmed "with a 99% confidence level" (Seife, 2001, pp. 2227, 2228).

However, even before the SNO results reportedly confirmed the SSM, the SNP was not the only difficulty for the SSM. In the SSM the sun has a nuclear "burning" core which extends some 25 percent of the distance out from the center of the sun and is often assumed to include about 10 percent of the solar mass. The density of the core is usually described as having about 150 times the density of water, or roughly 15 times the density of lead. Traditionally the core has been modelled as physically isolated from the solar structure above it. The only transfer which occurs out of the core is that of radiative energy (except for the transfer of neutrinos). In recent years, however, the He-3 instability problem has generated speculation that there must be some mixing between the core and outer layers. But there is another phenomenon which indicates a high degree of mixing in the sun, namely, the existence of certain solar modes of oscillation. The study of solar oscillations, or helioseismology, began in 1960 with the discovery, from Doppler shift photospheric observations, of vibrations with periods of about 5 minutes. Such oscillations are now a well recognized aspect of solar behavior (Fix, 1999, p. 395).

Helioseismology Indicates that the Sun Is Somewhat Homogeneous

High frequency (short period) modes, such as the 5 minute oscillation, "resonate within the outermost parts of the Sun and give very little information about the interior. Longer wavelength modes... penetrate much more deeply into the Sun" (Fix, 1999, p. 395). Modes of sufficiently low frequency should be able to penetrate the sun's central region.

However, the presence of a large core as called for in the SSM would place a maximum limit of about one hour on the period for solar oscillations. Astrophysical theorist Keith Davies has noted that "oscillations greater than one hour would involve such enormous amounts of energy that they would result in the disruption of any large core

---

*Jonathan F. Henry, Ph.D., Science Division, Clearwater Christian College, 3400 Gulf-to-Bay Boulevard, Clearwater, FL 33759

Received 23 December 2001; Revised 26 July 2002

that might be present in the Sun" (Davies, 1996, p. 2). Despite the implications of the SSM that such an oscillation should not exist, an oscillation with a period of 2 hr 40 min was observed in the sun during the 1970s. This discovery was discussed in two key articles, one written by Russian collaborators, and the other by a British team of scientists (Severny et al., 1976, pp. 87–89; Brooks et al., 1976, pp. 92–95).

The British team developed a solar model which would produce the observed long-period oscillation, but in doing so, found that their model sun must be nearly homogeneous without a well-developed central core. Their model (Brookes et al., 1976, p. 94) indicated that a totally homogeneous sun would have an oscillation with a fundamental of 2 hr 47 min. The Russian team noted that a "most striking fact is that the observed period of 2 hours 40 minutes is almost precisely the same... as if the Sun were to be a homogeneous sphere" (Severny et al., 1976, p. 88). The British group stated a similar conclusion: "Current solar models predict a period of about 1 hour corresponding to a steep density increase in the solar interior, in marked contrast to the observed 2.65-hour period, which is consistent with a nearly homogeneous model of the sun" (Brookes et al., 1976, p. 94).

Of course, a nearly homogeneous sun would not support the extremely high core temperatures assumed to drive most of the fusion reactions of the SSM. With the mixing which homogeneity implies, He-3 production could take place with hydrogen brought into the core, except that the central temperature of the sun would be too low. Indeed, the only fusion reaction which appears to be occurring is hydrogen fusion at a low rate which supplies only a portion of the sun's luminosity. Thus the sun appears to be a young, relatively undifferentiated star which has not yet developed the massive and extremely dense core assumed by the SSM.

Astronomer Ian Nicholson recognized this challenge to the SSM, for he stated that if the observation of the 2 hr 40 min period were correct, the "standard model could not be correct" and that the "central temperature of the Sun would be less than half the conventional value" (Nicholson, 1982; Davies, 1996, p. 3). Other astronomers made similar comments, writing that it was "evident that a very drastic change in the solar model would be necessary" and that "it is unlikely that any such model can be found" (Christensen-Dalsgaard and Gough, 1976, p. 90)—at least, not any model that would support a 10 billion year main sequence chronology for the sun.

The implications for evolution of the 2 hr 40 min oscillation led to speculation that perhaps this oscillation might be a deep seated gravity wave or "g wave," discussed at more length below. Indeed, Christensen-Dalsgaard and Gough (1976, p. 90) opined that unless this were so, "a very drastic change in the solar model would be necessary to enable the 2 h 40 min oscillation to be interpreted as [a] fundamental radial mode," yet this was the very claim made by Severny et al. (1976, p. 89). In a similar vein, Van der Raay (1980, p. 535) noted that "the measured period of 160 minutes raised an immediate conflict with the standard solar model since if these were simple radial oscillations the longest period predictable was approximately 60 minutes." The way out of this evolutionary quandary, Van der Raay emphasized, would be for "the oscillations [to] be interpreted in terms of more complex g mode oscillations" (Van der Raay, 1980, p. 535). As will be discussed below, g-waves have not been detected in the sun to date, yet several years later the 2 hr 40 min period continued to be accepted as a genuine phenomenon (Grec et al., 1980, p. 544). Even later, Ando (1985, p. 177) expressed doubt that the 2 hr 40 min oscillation could be a g-wave, but rather was a radial wave, as had been originally proposed by Severny et al. (1976, p. 89).

Another possibility brought forth to avoid revising the SSM is to explain the 2 hr 40 min oscillation as a beat frequency resulting from "p-modes" near the 5 min period. This possibility, however, was shown to be invalid (Delache and Scherrer, 1983, p. 653). Scherrer and Wilcox (1983, p. 37) described this idea as "incorrect." Woodard and Hudson (1983, p. 67) stated that they did "not detect the 160-min oscillation," but acknowledged that such detection "might not have been expected in [the] data set" they employed, making their claim of non-detection moot.

It was also pointed out that 2 hr 40 min (160 min) is one-ninth of a 24-hr day, and "could therefore appear in [the solar] spectrum as a harmonic" (Scherrer and Wilcox, 1983, p. 37). This was ruled out by the improved observation that the so-called 160-min oscillation in fact had a period of 160.0095 ± 0.001 min, meaning that this oscillation was not a simple fraction of the day and was therefore not a harmonic. This conclusion was later confirmed by Hill et al. (1986, p. 560).

It cannot be ruled out that the 2 hr 40 min oscillation may not be a permanent solar phenomenon. Indeed, it has been proposed that solar oscillations may be related to variable internal core rotations within the sun (Isaak, 1982, p. 131). Furthermore, although the sun is an "exceptionally stable" star (Seife, 1999, p. 15), it is gradually becoming recognized as somewhat variable in much of its behavior, a point first made some two decades ago due to the evolutionary questions raised by the SNP, helioseismology, and observations of solar shrinkage (Frazier, 1979, pp. 86–87). However, even the temporary existence of such a phenomenon as the 2 hr 40 min oscillation opens a window on the sun which reveals that the SSM is not accurate.

Solar Mixing May Reveal Internal Isotope Abundances

The evident near-homogeneity of the sun has the interesting implication that surface gas composition would be related to core composition. In the SSM this is held not to be true (Davis, 1994, p. 24), and all interior composition abundances must be modelled. In turn, the composition of surface gases and related phenomena such as solar flares and solar wind is taken to represent the primordial composition of the solar nebula (Bahcall, 1989, p. 174).

If the sun were generally recognized as homogeneous, then the surface composition could be taken as indicative of internal composition, but of course this is not conventionally done. Indeed, it has not been done since the early years of the twentieth century, when Saha derived a quantitative relationship between stellar spectra and temperature (1920, 1921), thus somewhat divorcing stellar spectra from intimations of composition (Eddington 1926, pp. 1–2, 345–346), and evolutionary astronomer A.S. Eddington assumed that stars like the sun undergo no convective transfer from the core to outer layers. It is generally assumed therefore that internal composition must be modelled. But in a totally homogeneous sun, internal He abundance, for instance, would equal surface abundance, and there would be no central depletion.

Let us assume the sun was created with no deuterium, and based on a solar neutrino detection ratio of about 1/2 (the detection rate acknowledged before the SNO results were announced), that hydrogen fusion to deuterium is supplying half of the sun's luminosity according to the reaction $H + H \rightarrow D + e^+ + í_e$. Let us further assume that the deuterium produced is not consumed. Would the amount of deuterium thus produced at the lower rate over the biblical age of the sun (of the order of thousands of years) correspond to the measured abundance of deuterium in the sun today?

The sun has a luminosity of about 4 x 10^{26} J. The deuterium-producing reaction mentioned in the previous paragraph is thought to release 1.44 MeV of energy, or 2.3 x 10^{-13} J. Every second this reaction occurs 1.7 x 10^{39} times. Over the age of the sun, say, some 6000 yr or 1.89 x 10^{11} s, this reaction has occurred 3.3 x 10^{50} times. Each reaction produces one atom of deuterium, so 3.3 x 10^{50} atoms of D have been produced, or 1.1 x 10^{24} kg of D. The mass of the sun is about 2.0 x 10^{30}kg, so the present mass fraction of deuterium throughout the sun would be 5.3 x 10^{-7}, or 0.00005 percent, assuming that the sun is homogeneous. A deuterium mass fraction of 5 x 10^{-7} in the sun is equivalent to a homogeneous D/H ratio of 7 x 10^{-7}. For the interstellar medium (ISM), the D/H ratio is in the range 3 x 10^{-6} to 3.9 x 10^{-5} (Ferlet et al., 2000, p. 3). Thus the D/H ratio in a homogeneous sun is within an order of magnitude of the observed abundance of deuterium in the interstellar medium. For a slightly older sun, say on the order of 10,000 years, the agreement is improved with a solar D/H ratio of 1.2 x 10^{-6}. Further, if the SNO results can be taken to imply that perhaps deuterium production produces more than half the sun's luminosity, the agreement between the sun's surface deuterium abundance and that of the ISM would be improved yet again. One must be careful, however, not to infer from such a possibility that SNO has confirmed the SSM, since the presumed reactions of the SSM are contradicted by helioseismology.

In contrast to these conclusions, the sun is typically assumed to be depleted in deuterium at present due to production of He-3, and the primordial D/H ratio is usually taken as 2 x 10^{-5} (Hubbard, 1984, p. 10; Ouyed et al., 1998, p. 371). This value is loosely inferred from the D/H ratio now existing in the Jovian planets on the assumption that planetary deuterium represents the primordial abundance in the solar nebula (Hubbard, 1984, p. 8). However, planetary abundances of deuterium do not agree well with the putative primordial D/H ratio (Hubbard, 1984, pp. 244, 272, 284), and planetary D/H ratios themselves are not uniform. In a biblical creationist framework, this putative ratio never existed, and the perceived difficulty of squaring planetary abundances of deuterium with that of the sun disappears.

Thus the D/H ratio in the sun after some thousands of years of hydrogen fusion would be nearly comparable to the observed D/H ratio in the ISM. In the SSM (and in stellar evolution models in general), it is assumed that deuterium is continuously consumed within the stellar core to produce He-4, and that deuterium in the ISM and in the intergalactic medium (IGM) is primordial material produced in the Big Bang.

One would therefore expect that the D/H ratio would be more or less uniform throughout the cosmos if this were true. That is not at all the case. Instead, the D/H ratio is found to vary within the solar system as mentioned above, but also within galaxies, and even within the IGM in ways that evolutionary models cannot predict. Discoveries of unexpected D/H ratios are often described as a "surprise." Regarding the D/H ratio in the solar system (Saturn), Griffin (2000, p. 1) calls it a "big surprise." The D/H ratio outside the solar system (in Orion) to Schilling (1999, p. 1) is also a "surprise." The low D/H ratio in Orion (50 percent of that predicted) may be explained by the fact that only molecular D and H were detectable, and undetected atomic D and H may make up the deficiency. However, the evolutionary prediction did not take this possibility into account, and this possibility was formulated only after the original evolutionary prediction had failed.

If the sun were homogeneous, and had generated deuterium since creation via hydrogen fusion, the deuterium would eventually mix with surface gases, some of which would leave the star to form the ISM. The resemblance between the sun's D/H ratio, and that of the ISM, would seem to imply that this may be the case. Other stars in the galaxy would similarly contribute to the IGM.

Let us consider the D/H ratio in the ISM from a creationist perspective. We cannot go back to observe the original sinless state of the universe, but we have the biblical record to guide us in visualizing that condition. Genesis 1:14–18 states that the stars were created to be time tellers, which would require that they be easily visible. Furthermore, Genesis 1:31 tells us that the sinless creation was very good, meaning among other things, that the ordained purposes of each part of the creation were fulfilled without obstruction or diminution. A possible conclusion is that there may have been originally little or no ISM or IGM to result in the extinction of starlight travelling to earth.

This last statement is buttressed by the fact that the ISM is now believed to have come primarily from the stars themselves, which means that when the universe was extremely young, there would have been little accumulation of ISM. Fix (1999, pp. 505–513) presents an overview of the ISM which confirms this analysis. He estimates that 20 percent of the Milky Way is ISM (Fix, 1999, p. 505), presents the typical scenario of stars evolving in certain interstellar gas structures, but then also describes the formation of interstellar dust grains from material flowing into space *from* stars. The acknowledgment that dust grains originate from stellar material is a change from what was believed among evolutionists in the past. Dust grains in the past were assumed to be formed directly from primordial material. However, the improbability of generating dust grains in this manner was eventually recognized. Slusher (1980, pp. 17–19) presents a summary of the problems associated with the alleged formation of primordial ISM.

Coupled with this assessment is the fact that planetary and stellar catastrophes are known to generate dust and debris. In the solar system, collisions between planetary ring debris, or between asteroids, are commonly acknowledged to form dust (though of course different in composition from the ISM). Likewise, it is commonly acknowledged that unstable stars of various sorts add material to the ISM and to the IGM. Furthermore, all stars produce a stellar wind which adds to the ISM/IGM. These known facts are in direct contrast to the evolutionary belief that the ISM/IGM is somehow primordial and is the source from which all the structure of the universe arose.

Studies of present-day processes such as deuterium fractionation in interstellar dust grains will ultimately shed no light on the origins of the universe, because the ISM and the IGM do not have to do with the origin of the universe. They have to do with stellar decay. Furthermore, it can be expected that missions such as the Advanced Composition Explorer (ACE) which are measuring solar wind composition will continue to reveal more questions than answers, as long as the solar wind is believed to represent primordial composition.

Modern Helioseismic Data Confirm a Degree of Solar Homogeneity

How has evolutionary philosophy dealt with the implications of the 2 hr 40 min oscillation? The oscillation is acknowledged to exist, but the implications are ignored, and the SSM continues to be taught and applied as if it were reality. Astronomer John D. Fix (1999, p. 396) presents a typical treatment. Fix does not deny that the 2 hr 40 min oscillation exists. Indeed, a diagram is used to show that "long wavelength oscillations probe the deep interior of the Sun" (Fix, 1999, p. 396). Fix does not misrepresent that very low frequency oscillation in any way confirms the SSM. He is merely silent on the matter.

Yet Keith Davies points out that new evidence continues to indicate that the sun is at least somewhat homogeneous. One such finding is that "the temperature at the center of the Sun seems to be varying over a period of several months. This is extremely hard to understand if the Sun has a huge central core with a resulting enormous heat capacity. However, such rapid temperature changes are explicable if the Sun is young and homogeneous" (Davies, 1996, p. 2; Chown, 1995, p. 16). Such temperature variation may also be related to the oscillatory neutrino flux found by experiments such as GALLEX.

In total contrast to the assertions of Keith Davies, it is commonly stated that helioseismology actually supports the SSM. A typical statement is the following: "In recent years acoustic oscillations of the sun's surface have been used to investigate its internal structure; the frequencies of the oscillations calculated from the standard model agree with the thousands of observed values to better than 1 percent" (Bahcall, 1990, p. 56). How can two such opposite positions be true simultaneously? Of course, they cannot. Indeed, there is a type of circular reasoning involved in analyzing helioseismological results to bring about a fit with the SSM: "Theorists turn to current models of the sun to differentiate and analyze the various acoustic modes; the modes, in turn, help to refine the standard model of the sun" (Bartusiak, 1990, p. 25). Such model-fitting is based ultimately on the assumption of high opacity for the radiative region of the sun. But the assumption of high opacity is ultimately based on the assumption that the sun cannot be younger than the evolutionary age of the earth. The high opacity has never been observationally verified, only modelled.

Nevertheless, with the assumption of high opacity and the corresponding low rate of thermal energy transmission, one can assume that solar modes transfer energy adiabatically throughout most of the radius, therefore resulting in little or no mixing, and in turn preserving the conventional picture of the sun with its high thermal gradient and segregated core. Along this line of thought, Bartusiak (1990, p. 29) has noted, "Estimating the sun's opacity... affects how modal frequencies are calculated from the Doppler information." Thus, the computed frequencies are model-dependent.

In a similar vein, Christensen-Dalsgaard et al. (1996, p. 1288) state, "In almost the entire solar interior, the thermal time scale is so long, compared with the periods of oscillation, that the oscillations can be regarded as adiabatic." They then write:

> The adiabatic approximation breaks down near the surface. Here the full energy equation for the oscillations must be considered, including the perturbation in the radiative flux and the highly uncertain perturbation in the convective flux. [One suspects that these conditions ought to be assumed for the deeper interior as well.]... [Below the surface layers] we consider only the adiabatic oscillations and generally treat convection according to the simple mixing-length prescription, neglecting effects of turbulent pressure [i.e., large-scale mixing is ruled out]; it is then straightforward to compute numerically precise frequencies for a given solar model (Christensen-Dalsgaard et al., 1996, p. 1288).

Concerning the assumption of adiabatic behavior, Gough et al. (1996b, p. 1299) state, "Except in the surface layers of the sun, the characteristic cooling time is much longer than the periods of the seismic waves, so the wave motion is essentially adiabatic." But the condition of long cooling time, or long thermal time-scale, is only an assumption based on the prior assumption of high opacity.

However, modifications of the SSM to fit helioseismological modes do not fit other solar characteristics. Douglas Gough and colleagues have written,

> Immediately beneath the convection zone and at the edge of the energy-generating core, the sound-speed variation is somewhat smoother in the sun than it is in the model. This could be a consequence of chemical inhomogeneity that is too severe in the model... or to neglected macroscopic motion that may be present in the sun (Gough et al., 1996b, p. 1296).

In other words, there is a degree of mixing in the solar interior, as discussed above, but which the SSM has typically ignored.

Gough et al. have proposed that core mixing with outer solar layers may in fact constitute a resolution to the SNP:

> The discrepancy in the energy-generating core might also be a symptom of macroscopic motion, which transports the products of the nuclear reactions from their sites of production. That would modify the neutrino emission rates and thereby change the status of the solar neutrino problem... (Gough et al., 1996b, p. 1299).

Other researchers have also recognized the probability of core mixing with outer solar layers. Newkirk (1983, p. 431–432) has discussed several models which would alleviate the SNP by mixing time scales of the order of 10^5 years or more. From a biblical creationist perspective, however, lengthy time scales do not exist, and it is significant that both Homestake and GALLEX neutrino researchers have proposed internal solar mixing over shorter time scales as a way of explaining the deficiency of both high energy neutrinos (Homestake) and low energy neutrinos (GALLEX) (Davis, 1994, p. 30; Kirsten, 1994, p. 34). It remains to be seen whether this possibility will continue to be considered, with the SNO results having reportedly confirmed the SSM. To ignore this possibility, however, would be to ignore the divergence between the SSM and helioseismology.

Other data confirm that a relatively high degree of mixing may be occurring in the sun. The high angular momentum of the planets compared to the sun has been a long-standing problem for evolutionary models of solar system origins. It has become accepted that the sun, which allegedly possessed high angular momentum acquired from the solar nebula, has undergone a process of angular momentum transfer to the planets mediated by the solar magnetic field. This model of the sun's relatively low angular momentum leads to the expectation that the sun would now have a relatively small internal rotation. Over 4.5 billion years "it is therefore believed that the sun has been losing angular momentum over its lifetime through its magnetized wind, thereby spinning down its outer convection zone and probably the bulk of its interior" (Thompson et al., 1996, p. 1300).

Contrary to this expectation, helioseismic observations imply the existence of a relatively high spin rate in the solar interior (Claverie, et al. 1981, p. 443; Isaak, 1982, p. 130). Such a conclusion imposes constraints on the alleged 4.5 billion year age of the sun, since evidently the sun has not had so much time to spin down. But more to the point, the relatively high internal spin rate implies significant internal shear and mixing, two conditions consistent with a degree of homogeneity. Although in a biblical creationist model spin down over 4.5 billion years has not occurred, there is nevertheless "rapidly rotating plasma deeper in the convection zone" than previously believed (Thompson et al., 1996, p. 1301).

Interpreting such plasma motion as an artefact of spin down, GONG (Global Oscillation Network Group) researchers have acknowledged that, "The spin down to the present state... may have involved material motion or instabilities, leading to mixing in the solar interior and thus affecting the structure of the present sun..." (Christensen-Dalsgaard et al., 1996, p. 1287). The rotation rate of the core is not certain at this time (Thompson et al., 1996, p. 1301). However, it is thought that perhaps the core rotation rate may be "considerably faster than that of the solar surface" (Thompson et al., 1996, p. 1304), a conclusion echoing the earlier claim of Claverie et al. (1981, p. 443) that the core rotation is "2–9 times [faster] than the observed surface rotation," a point which further indicates solar homogeneity.

There are other implications of the apparent homogeneity of the sun. If the sun is nearly homogeneous, then a highly segregated, dense core as predicted in the SSM would not exist. Oscillations of the sun which are detectable from Doppler shifting at the surface are called "p-modes." If the sun's core were dense, it should support the existence of gravity waves or "g-modes" (Bartusiak, 1990, p. 26). However, "no internal gravity wave has yet been unambiguously seen" (Gough et al., 1996a, p. 1201). The absence of g waves seems to imply that the solar core may not be as dense as typically expected. GONG scientist Christensen-Dalsgaard has indicated his hope that g waves will be detected, because "they would really allow us to nail down the conditions in the core" (Hellemans, 1996, p. 1265). He apparently expects that the detection of g waves would verify the existence of the dense core assumed in the SSM, a verification which has not yet happened.

Helioseismology has not confirmed the SSM, but has revealed further discrepancies between the SSM and reality. The SSM has been modified to enlarge the convection zone to some 30 percent of the solar radius, compared with the 20 to 25 percent it was assumed to occupy before the advent of helioseismology (Bartusiak, 1990, p. 28; Christensen-Dalsgaard et al., 1996, p. 1287). Nevertheless, the SSM most likely cannot be made to fit the helioseismic discoveries discussed above while simultaneously satisfying the SNP. Christensen-Dalsgaard et al. (1996, p. 1290) state, "No solution of the neutrino problem can be found by modifying the computation of solar models while at the same time preserving agreement with the helioseismic data..."

Of course, if the restrictive and unrealistic assumptions of the SSM were dropped, and a realistic solar model developed, consistency would appear among solar properties, solar neutrino data, and helioseismic data. However, abandoning the SSM would mean abandoning the evolutionary chronology for the sun. Rather than taking that route, Christensen-Dalsgaard et al. (1996, p. 1290) opine that the lack of agreement between the SSM and real data strengthens "the case for a solution involving the properties of the neutrinos." Neutrinos have typically been assumed to be massless, but if the neutrino mass were not zero, it is felt that the SNP might be resolved if it could be shown that such neutrinos might transform or "oscillate" into other forms in a phenomenon known as the Mikheyev-Smirnov-Wolfenstein (MSW) effect. The sun produces "electron neutrinos" (í_e), but there also are thought to exist mu neutrinos $\text{í}_{\text{ì}}$ and tau neutrinos $\text{í}_{\text{ô}}$.

According to the neutrino oscillation theory, í_e generated in the sun might "oscillate" before arriving at earth, becoming virtually undetectable $\text{í}_{\text{ì}}$ or $\text{í}_{\text{ô}}$, and thus explaining the solar neutrino shortage (Bahcall, 1989, pp. 28–32, 258–284). It is believed that massless neutrinos could not experience such a transformation, however, thus neutrinos must have a non-zero mass for the MSW effect to explain the SNP. Before the announcement of the SNO results, this idea had not been confirmed (Antia, 1998, p. 155; Normille, 1999, p. 1910), but the SNO results reportedly confirmed the MSW effect (Seife, 2001, p. 2227). The irony since the announcement of the SNO results is that the discrepancies between the SSM and helioseismology are still unexplained. The implication of these discrepancies is that rather than using the SNO results as a window to see what is really happening in the sun, the MSW effect has served more as a vehicle for "saving" the SSM in particular and evolutionary chronology in general.

Conclusion

Recent experiments in helioseismology such as GONG and SOHO have not resolved the discrepancies between the SSM and the implications of helioseismology concerning the internal structure of the sun. The helioseismic implications of reports published in the 1970s remain essentially true today, namely, that the sun is somewhat homogeneous with a relatively low core density. Such conditions limit the maximum core temperature for the sun, imply a relatively low opacity, and are consistent with the implication of the SNP as understood before the publicizing of the SNO results, namely, that hydrogen fusion into deuterium is occurring at a temperature of some 1 million K or less in the core.

References

Ando, H. 1985. Resonant excitation of the solar g-modes through coupling of 5-min oscillations. *Astrophysics and space science*. 118:177–181.

Antia, M. 1998. First glimpse of the last neutrino? *Science*. 281:155.

Bahcall, J.N. 1989. *Neutrino astrophysics*. Cambridge University, Cambridge.

Bahcall, J.N. 1990. The solar neutrino problem. *Scientific American*. 262(5):54–61.

Bartusiak, M. 1990. Seeing into the sun. *Mosaic*. 21(1): 24–32.

Brookes, J.R., G.R Isaak, and H.B. van der Raay. 1976. Observations of free oscillations of the sun. *Nature*. 259: 92–95.

Chown, M. 1995. The riddle of the solar wind. *New Scientist*. 147(2042):16.

Christensen-Dalsgaard, J., and D.O. Gough. 1976. Towards a heliological inverse problem. *Nature*. 259:89–92.

Christensen-Dalsgaard, J., W. Dappen, S.V. Ajukov, E.R. Anderson, H.M. Antia, S. Basu, V.A. Baturin, G. Berthomieu, G. Chaboyer, S.M. Chitre, A.N. Cox, P. Demarque, J. Donatowicz, W.A. Dziembowski, M. Gabriel, D.O. Gough, D.B. Guenther, J.A. Guzik, J.W. Harvey, F. Hill, G. Houdek, C.A. Iglesias, A.G. Kosovichev, J.W. Leibacher, P. Morel, C.R. Proffit, J. Provost, J. Reiter, E.J. Rhodes Jr., F.J. Rogers, I.W. Roxburgh, M.J. Thompson, and R.K. Ulrich. 1996. The current state of solar modelling. *Science*. 272:1286-1292.

Claverie, A., G.R. Isaak, C.P. McLeod, and H.B. Van der Raay. 1981. Rapid rotation of the solar interior. *Nature*. 293:443–445.

Davies, K. 1996. Evidences for a young sun. *Impact*. No. 276. Institute for Creation Research, El Cajon, CA.

Davis, R. 1994. A review of the Homestake solar neutrino experiment. *Progress in particle and nuclear physics*. 32: 13–32.

Delache, P., and P.H. Scherrer. 1983. Detection of solar gravity mode oscillations. *Nature*. 306:651–653.

Eddington, A.S. 1926. *The internal constitution of the stars*. Dover, New York. Reprinted 1959.

Ferlet, R., M. Lemoine, and A. Vidal-Madjar. 2000. Deuterium in the local interstellar medium. *Science with the Hubble Space Telescope II* (editors, P. Benvenuti et al.).

http://www.stsci.edu/stsci/meetings/shst2/ferletr.html

Fix, J.D. 1999. *Astronomy*. WCB/McGraw-Hill, Boston.

Frazier, K. 1979. *Our turbulent sun*. Prentice-Hall, Englewood Cliffs, NJ.

Gough, D.O., J.W. Leibacher, P.H. Scherrer, and J. Toomre. 1996a. Perspectives in helioseismology. *Science*. 272:1281–1283.

Gough, D.O., A.G. Kosovichev, J. Toomre, E. Anderson, H.M. Antia, S. Basu, B. Chaboyer, S.M. Chitre, J. Christensen-Dalsgaard, W.A. Dziembowski, A. Eff-Darwich, J.R. Elliot, P.M. Giles, P.R. Goode, J.A. Guzik, J.W. Harvey, F. Hill, J.W. Leibacher, M.J.P.F.G. Monteiro, O. Richard, T. Sekii, H. Shibahashi, M. Takata, M.J. Thompson, S. Vauclair, and S.V. Vorontsov. 1996b. The seismic structure of the sun. *Science*. 272:1296–1300.

Grec, G., E. Fossat, and M. Pomerantz. 1980. Solar oscillations: full disk observations from the geographic South Pole. *Nature*. 288:541–544.

Griffin, M. 2000. Saturnine remains of the big bang. http://isowww.estec.esa.nl/outreach/esa_pr/satu_rms.htm

Hellemans, A. 1996. SOHO probes sun's interior by tuning in to its vibrations. *Science*. 272:1264–1265.

Hill, H.A., J. Tash, and C. Padin. 1986. Interpretation and implications of diameter and differential radius observations of the 160 minute period solar oscillation. *Astrophysical Journal*. 304:56–578.

Hubbard, W.B. 1984. *Planetary interiors*. Van Nostrand Reinhold, New York.

Isaak, G.R. 1982. Is the sun an oblique magnetic rotator? *Nature*. 296:130–131.

Kirsten, T.A. 1994. GALLEX solar neutrino results and their implications. *Progress in Particle and Nuclear Physics*. 32:33–34.

Newkirk, G. 1983. Variations in solar luminosity. *Annual Reviews of Astronomy and Astrophysics*. 21:429–467.

Nicholson, I. 1982. *The Sun*. Michael Beazley, London.

Normille, D. 1999. Experiment uses nuclear plants to understand neutrinos. *Science*. 284:1909–1911.

Ouyed, R., W.R. Fundamenski, G.R. Cripps, and P.G. Sutherland. 1998. D-D fusion in the interior of Jupiter? *Astrophysical Journal*. 501:367–374.

Scherrer, P.H., and J.M. Wilcox. 1983. Structure of the solar oscillation with period near 160 minutes. *Solar Physics*. 82:37–42.

Schilling, G. 1999. Heavy hydrogen is elusive in Orion. http://www.apnet.com/insight/03181999/graphb.htm

Seife, C. 1999. Thank our lucky star. *New Scientist*. 161: 15.

Seife, C. 2001. Polymorphous particles solve solar mystery. *Science*. 292:2227–2228.

Severny, A.B., V.A. Kotov, and T.T. Tsap. 1976. Observations of solar pulsations. *Nature*. 259:87–89.

Slusher, H.S. 1980. *Age of the cosmos*, Institute for Creation Research, El Cajon, CA.

Thompson, M.J., J. Toomre, E.R. Anderson, H.M. Antia, G. Berthomieu, D. Burtonclay, S.M. Chitre, J. Christensen-Dalsgaard, T. Corbard, M. DeRosa, C.R. Genovese, D.O. Gough, D.A. Haber, J. W. Harvey, F. Hill, R. Howe, S.G. Korzennik, A.G. Kosovichev, J.W. Leibacher, F.P. Pijpers, J. Provost, E.J. Rhodes Jr., J. Schou, T. Sekii, P.B. Stark, and P.R. Wilson. 1996. Differential solar rotation and dynamics of the solar interior. *Science*. 272:1300–1305.

Van der Raay, H.B. 1980. Solar oscillations. *Nature*. 288: 535–536.

Woodard, M., and H. Hudson. 1983. Solar oscillations observed in the total irradiance. *Solar Physics*. 82:67–73.

Notes from the Panorama of Science

Natural History or Natural Science?

John K. Reed*

We have heard that knowledge is power and that he who controls the past owns the future. Two of the three 20th century attempts to rewrite history in the pursuit of power failed; the jury is still out on the other. Nazis and communists both briefly flourished, but ultimately failed to hijack history from its Christian foundation. Like Christianity, both recognized in history an irresistible force moving to a utopian future, but their material future required killing millions. Those two scourges have withered, but a subtler secularism continues, surrounding us in education, entertainment, the arts, and science. Especially science.

The common bond of the three secular histories is a denial of both God's acting and revealing. However, all three retained the Christian sense of history's importance and the mission consciousness derived from it. A robust sense of history is a markedly Christian endeavor (Glover, 1984), but in most other regards, secular history is markedly anti-Christian; most clearly so in the arena of natural history. In one corner is the tag team of Lyell and Darwin. In the other, the Word and the Spirit.

Secularism's weak link in natural history is an internal conflict between its path to knowledge, positivism, and its historiographic tenet of uniformitarianism (Reed, 2001). Positivism is the view that "science" encompasses all knowledge really worth having, at the expense of theology, philosophy, and history. Thus, natural history is by definition a subset of science. Uniformitarianism is the means of extrapolating modern observation into the remote past. The dilemma is observed by noting that any flexibility in uniformitarianism increases uncertainty in natural history, but observation demands such flexibility. By sacrificing theology for science, secularism fails to justify 1) the importance of history, 2) its philosophical foundations, and 3) an accurate record of many important events. Therefore, creationists need to maintain a strong distinction between science and history to avoid similar errors.

The biblical approach to history is quite different from the secular. Believing history to be just another variant of science, secular scholars perpetuate an epistemology that is anti-Christian in its elevation of science above revelation. This in turn leads to unwarranted confidence in their interpretations of singular past events. Ironically, it also leads to confusion in trying to think about theological and philosophical issues after having denied the validity of thought in those domains. This final point is well illustrated by a recent paper (Cleland, 2001) that gamely attempts to justify "historical science."

Cleland (2001) sets out to explain "why historical science is not inferior to experimental science when it comes to testing hypotheses." (p. 987). She writes in opposition to a statement by Henry McGee, editor of Nature, who stated that hypotheses pertaining to the remote past "… can never be tested by experiment, and so they are unscientific…" (McGee, 1999, cited in Cleland, 2001). Her concern is exacerbated by "The startling number of physicists and chemists who attack the scientific status of neo-Darwinian evolution…" (p. 987). Since in her mind there cannot be anything wrong with neo-Darwinism, then all the physicists and chemists need educating (or is it re-educating?) to see that natural history is the same science that they have embraced in their laboratories.

I share Cleland's interest in defining the proper home of natural history, but believe that she has become lost along the way. Our mutual interest can be seen in two questions:

- can science provide knowledge of the past? and
- if so, how?

I agree with Cleland that the answer to the first question is "yes", but radically disagree on her answer to the second. Before explaining how I believe creationists should answer the second question, I will recap Cleland's answer, critique her approach, and then discuss some implications for creationism.

Justifying Historical Science: A Positivist Approach

Cleland upholds the positivist view that knowledge of past events is "science" of the same epistemic quality as experimental science. The two are only distinct in methodology. She relies upon two arguments to support her case: (1) experimental science really does not test hypotheses as advertised (lowering the bar for "historical science"), and (2) the nature of time forces a change in the method of hypothesis testing between experimental and historical science, without changing their epistemic value.

Cleland begins by describing the two modern scientific approaches to hypothesis testing, Baconian inductionism and falsificationism (commonly associated with Karl Popper). The former allows for the accumulation of positive evidence sufficient to prove a hypothesis, and the latter, recognizing that no amount of finite evidence can prove a universal generalization, relies instead on attempting to disprove a hypothesis by subjecting it to difficult tests. The

---

*John K. Reed, Ph.D., 915 Hunting Horn Way, Evans, GA 30809

longer it avoids being disproven, the more confidence it generates. Cleland points out two flaws in falsificationism: (1) the presence of an indeterminate number of auxiliary conditions so affect any attempts at falsification that one is left with no meaningful conclusion, and (2) scientists really do not work this way.

The difference in method between experimental and historical science is attributed to "the asymmetry of overdetermination" (p. 989).

> Localized events tend to be causally connected in time in an asymmetric manner. As an example, the eruption of a volcano has many different effects… but only a small fraction of this material is required in order to infer that it occurred… Running things in the other direction of time, however, produces strikingly different results. Predicting the occurrence of an eruption is much more difficult than inferring that one has already occurred. (p. 989).

Under that constraint, the "science" of testing historical hypotheses is endued with a wealth of data, or clues to the causes of historical events and scientists simply sift through it all looking for a "smoking gun" that will advance one hypothesis over another. Citing the impact hypothesis of dinosaur extinction and plate tectonics, she advocates a forensic model of natural history with geo-detectives searching eagerly for clues.

Christian Critique of "Historical Science"

The key to examining differences between Cleland's (2001) approach to natural history and its Christian alternative is found in their underlying theories of knowledge. Christians constrain all knowledge within the bounds of revelation; naturalists deny its content, authority, and epistemology. Residual similarities between Christian and naturalist approaches to science remain as a result of naturalists' covert use of assumptions justified by Christian theology. Uncovering this presuppositional pilfering demonstrates formal errors in Naturalism (Reed, 2001).

A consequence of these differences is the muddle that results when Christians buy into the epistemology of naturalists. At best, it results in lip service to revelation and an exegetical style driven by "science." The subordination of revelation to science (e.g., Hugh Ross) warps Christian theology and ultimately destroys the possibility for establishing a Christian basis for truth in anything. Ironically, a capitulation to positivism is destructive of science: if there can be no truth, then there can be no truth in science, either. Cleland (2001) ignores the epistemological conflict (as do most naturalists), but cannot escape the consequences of her choice of ultimate truth.

One consequence is the loss of sharp distinctions between various forms of knowledge. This fundamental error bred into positivistic approaches is evident in Cleland's efforts to force the square peg of science into the round hole of history. Her task would be much easier if she only had more confidence in her own profession of philosophy. Adler (1965) not only provided a clear distinction between science, history, philosophy, and mathematics, but he noted that the basis for this classification was philosophical, not scientific. Ordering both history and science as empirical, he made the crucial distinction between the two by noting that science pursues general rules by use of special experience (i.e., controlled observation), while history investigates specific past events.

Cleland misses Adler's distinctions completely. She attempts to tie experimental science and natural history together by asserting that experimental science predicts present *events*. This term is important, because she uses it to minimize the distinction between the methods of science and history. In her assertion, she skips an important logical step—that of extrapolating from general rules developed from repeated, controlled observation to a particular "event" prediction. For example, she states that experimental science determines that "all copper expands when heated" (p. 987), and states that this is a prediction of a present event, not a general rule from which the prediction rises. In confusing the two steps, she implies a predictive ability greater than warranted. Her imprecision at this point allows her to later defend "historical science" as predicting specific "events" when the prediction in the past is that of forensic deduction and that of the present is extrapolation of effect when the causes are known.

Outside of the laboratory, prediction of specific events is often stymied by uncertainty, even in the present. For example, meteorology applies scientific research (derived rules) to specific predictions of events every day, and every day we see a variety of uncontrollable uncertainties dash their predictions. Prediction of future events by experimental science is always an extrapolation of general rules under an assumed set of conditions that may or may not encompass reality. In other words, any predictions are contingent upon the chain of cause and effect containing all the "links" in the proper sequence. The less is known about the chain in general, the more uncertain the prediction of a particular sequence will be.

What about "historical science"? Does Cleland's "asymmetry of overdetermination" allow scientific certainty in historical prediction? Once the impressive vocabulary is peeled away, what she is essentially saying is that it is easier to see the past than the future because events have already occurred and left their mark on this world. She seems to have erected a straw man to force the comparison and her determination that there are more clues about what happened in the past than will happen in the future should elicit the response of "so what?"

Her problem lies in the limits of scientific prediction to specific, well-defined circumstances. Both past and future are replete with complicating factors. The real question is whether or not natural history is open to purely scientific investigation in the first place, and Cleland does not answer that question; she merely assumes that it is true.

Christians should recognize the difficulties rising from a past that is more than simply the sterile interplay of physical laws. It includes the volitional actions of both God and man, resulting in a tangle far greater than Cleland's purely physical "auxiliary conditions." Volition is by definition unpredictable, regardless of the time continuum. Naturalists react to the introduction of volition by closing their eyes to it; Christians manage the resulting uncertainty though the use of revelation. Absent revelation, any history is unreliable, both in content and structure.

Although naturalists deny revelation, their rejection of God does not remove His influence over the events of history. They are left covertly retaining the Christian assumptions that provide structure and method to history, while still trying to stamp out any divine intervention. Their dilemma can be illustrated by their dependence on uniformitarianism. They cannot justify uniformitarianism without reference to Christian theology (Reed, 1999), but they have no history without it.

The assumption of positivism leads to yet another error in Cleland's defense of historical science. Refusing to admit theology or philosophy onto the playing field, she defines the structural relationship between historical science and experimental science *scientifically*, by offering a physical explanation for the asymmetry of overdetermination. She states: "The physical source of the asymmetry of causation is controversial" (p. 989). But how does she know the source is physical? Explanations of causation are philosophical or theological, not scientific. Her commitment to naturalism is requires a physical source for any non-material conceptual construct. Cleland begins to founder at this point in her explanation.

> It has been variously explained in terms of the second law of thermodynamics (statistically interpreted), the radiative asymmetry—wave phenomena (e.g., water, light) diverge into the future from their sources—and the initial conditions of the universe (p. 989).

Although it might sound more sophisticated, a little thought shows that Cleland is squarely back to earth, air, fire, and water. Materialism cannot explain immaterial reality.

Cleland also does not appear to grasp the relative role of data and conceptual models. All scenarios devised in the practice of natural history include both data and a framework that is not scientifically defined. For example, Cleland cites extinction events and plate tectonics without comment on the complex interactions between construct and data. Both are more than data-tested hypotheses, including unscientific presuppositions. Sometimes the presuppositions drive the model against the data. Cleland should consider, for example, that evolutionists and creationists can evaluate the same data and propose wildly variant hypotheses of extinction events. It is not the data that differ, but clearly preconceived notions of what the data should reveal are at work on both sides. And even within the naturalist camp, she misses the data-rich opposition cogently offered to both plate tectonics and the Alvarez extinction model.

How Should Science and History Cooperate in Creationism?

So we return to the crucial questions,

- can science provide knowledge of the past? and
- if so, how?

The answer to the first is "yes," and the answer to the second is much more complex. I would suggest several propositions that would form a part of that answer:

- Acknowledgement of Christian worldview is essential in defining a framework within which both science and history exist and can cooperate.
- History and science are distinct areas of inquiry; each with their own special methods and questions (Adler, 1965);
- Natural history is a subset of history, not science (Reed, 2001);
- Investigations in natural history are "mixed questions" (Adler, 1965)—questions about which different disciplines can all contribute. The relative roles of the different disciplines must be governed by a method congenial to the Christian worldview.
- Thus, certainty in history depends on revelation, both for some of the essential facts of history (i.e., creation, fall, flood, etc.) as well as for the framework within which science can be applied to adduce details not provided by revelation.
- Outside of revelation, certainty in natural history remains more tentative than that within experimental science. Forensic investigation is appropriate, but the scope and limits of those investigations must be identified and honored.

Creationists are profoundly interested in natural history, evolution and uniformitarianism being the major points of disagreement with naturalists. We can agree with Cleland that science has a place in natural history, we must differ in how it is applied. Science can be one of several modes of gaining historical knowledge, but not the only one, or even the primary one. One outcome of a creationist approach to natural history should be the recognition that propositions absent the specific support of Scripture possess greater uncertainty than those grounded in revelation. Feasible explanations of what might have happened, given a specific set of circumstances, is the goal of the natural historian; the undue confidence of the positivist must be abandoned, no matter how attractive it may be.

References

Adler, M.J. 1965. *The conditions of philosophy*. Atheneum Press. New York.

Cleland, C.E. 2001. Historical science, experimental science, and the scientific method. *Geology* 29(11):987–990.

Glover, Willis. 1984. *Biblical origins of modern secular culture*. Mercer University Press. Macon, GA.

Reed, J.K. 2001. Historiography and natural history, in *Natural History in the Christian Worldview*. Creation Research Society Books, St. Joseph, Missouri.

The Possible Origin of Fossil Wood and Pollen in the Aguja and Javelina Formations, Big Bend National Park, Texas

George F. Howe, Emmett L. Williams, Carl R. Froede, Jr. *

The Aguja and Javalina Rock Formations

Sections of the Cretaceous Aguja and the Javelina formations we studied were within the Big Bend National Park, near Study Butte, Texas (Figure 1). The formations we examined contained abundant quantities of fossilized wood in deposits of bentonite. We previously discussed the stratigraphy of these formations and their possible modes of origin in a Flood geological context (Williams and Howe, 1993; see also Froede, 1994).

Over a period of about five years several reports were produced dealing with the anatomy and chemistry of the fossil wood specimens and the mineralogy of the bentonite clay deposits. We review our work and three articles by others, two on fossil wood and one on fossil pollen in the Big Bend. We will compare their data and conclusions with our own.

Gymnosperm Fossil Wood in the Javelina and Aguja Formations

We collected three forms of fossilized wood in the Dawson Creek area of Big Bend: charcoalified wood, silicified wood, and opalized or agatized wood (Williams and Howe, 1993). Charcoalified wood is also known as fusain, while silicified wood is sometimes referred to as permineralized wood or simply petrified wood. We found and collected samples of charcoalified wood in the Aguja formation but located no charcoalified wood in the Javelina at the region where we worked (Figures 4 and 7, Williams et al., 1998).

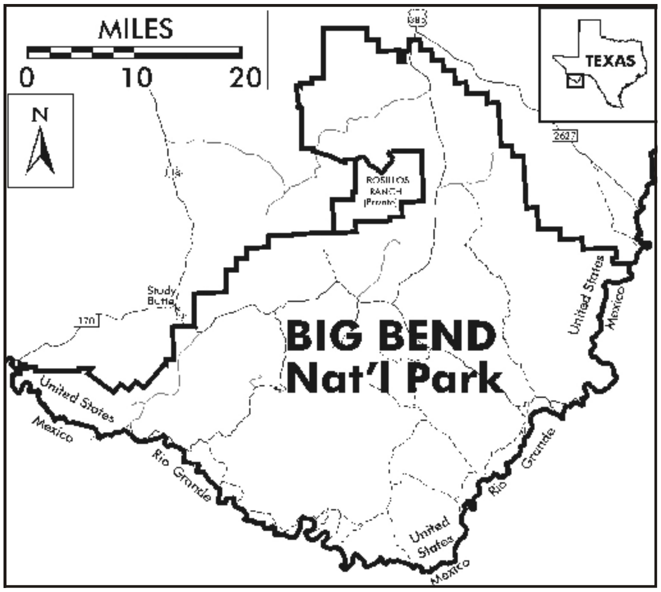

Figure 1. The investigation of petrified plant material and paleosols covered most of Big Bend National Park.

We found silicified wood in both the Aguja and Javelina Formations (Figure 1, Williams 1993; Figures 5, 6, 11, and 12, Williams *et al.*, 1993; Figures 8 and 9, Williams *et al.*, 1995; Figure 9, Williams *et al.*, 1998). Our opalized wood samples came from the Aguja (Figures 8 and 9, Williams *et al.*, 1993). See also Figures 2–5 of this report.

Light microscope photographs were taken of thin sections made from one silicified wood specimen and two coalified samples. Scanning electron photomicrographs were taken of two silicified wood samples and one charcoalified sample (see Figures 3 and 4 as well as Williams *et al.*, 1995).

Chemical Analysis and Trace Fossils

We carried out chemical analysis on charcoalified and silicified wood samples (Williams *et al.*, 1993; Williams *et al.*, 1995). The mineral content of three different bentonite clay samples was determined (Williams *et al.*, 1998a).

---

*George F. Howe, 24635 Apple St., Newhall, CA 91321-2614
Emmett L. Williams, P.O. Box 2006, Alpharetta, GA 30023-2006
Carl R. Froede, Jr., 2895 Emerson Lake Dr. Snellville, GA 30078-6644

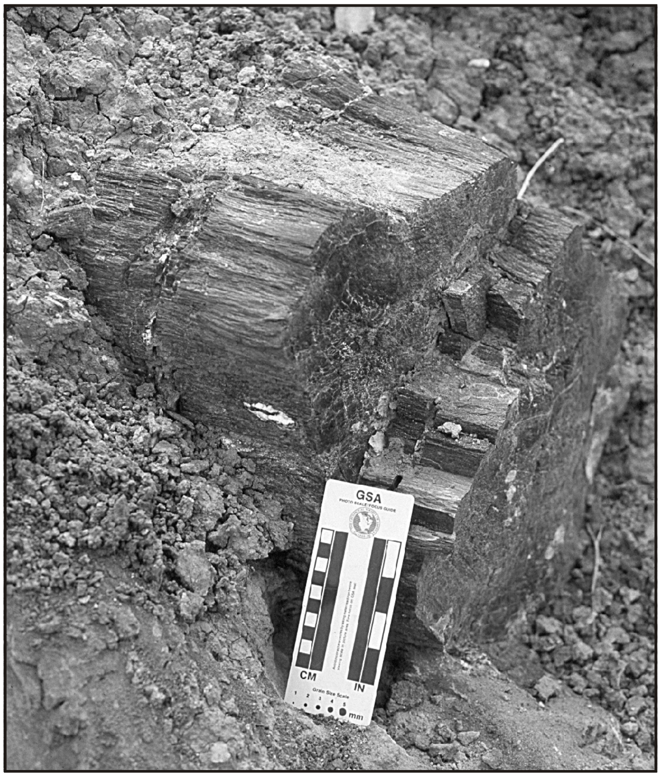

Figure 2. The end of this petrified log is exposed in the Aguja Formation in a clay sidewall. Note scale in inches and centimeters.

Figure 5 shows a petrified log from the Javelina Formation with fossilized termite galleries in it. (Williams and Goette, 1998b).

The Origin of Charcoalified Wood

While it was being exhumed, a charcoalified branch that we collected emitted a strong aroma of burned wood. Based on the fact that these volatile aromatic compounds were still lingering in the sample, and on other facts as well, we theorized that the log had undergone rapid charcoalification in relatively recent times. We discussed probable factors involved in the origin of such specimens (Williams *et al*., 1993). We think that exquisite cellular detail of the charcoalified wood is a tribute to the Creator's awesome design skills and to the obvious rapidity of fossilization, which prevented decay (see Figure 3 and Figure 4).

The Origin of Silicified Wood

Williams (1993) evaluated various mechanisms by which this wood may have become silicified. In two other papers (Williams and Howe, 1993; Williams *et al*., 1998a) possible factors leading to the genesis of the Javelina and Aguja bentonite beds themselves were discussed. The bentonite is composed of altered volcanic ash, which suggests a catastrophic mode of origin for the two rock formations and the silicified wood found in them.

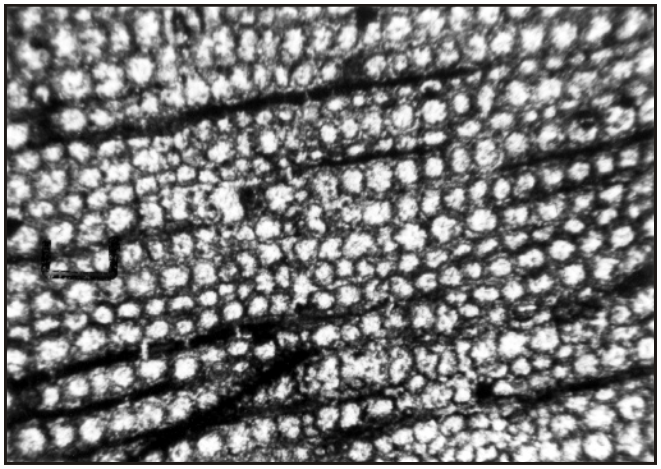

Figure 3. Thin section of fossil silicified gymnosperm wood from bentonite clay mound, south of park Road, Dawson Creek Region, Big Bend National Park. Note the many light-colored tracheids and the darker, radially arranged ray parenchyma cells. Scale bar is 100 micrometers (μm).

One and the same set of catastrophic environmental conditions could have fostered the production of all three: charcoalified wood that was baked by hot ash fall, silicified wood, and the bentonite beds. These factors are: 1. ample water (for the deposition and transport of trees, the weathering of volcanic ash for the bentonite beds, and for the water-logging of the wood), 2. low oxygen concentrations (for preventing decay of the wood), 3. vast quantities of volcanic ash (for production of bentonite and creation of silica-rich solutions for silicification of the wood), 4. numerous floating logs, and 5. localized high temperatures (for the charcoalification and silicification of logs). It is likely that in the Dawson Creek region the fossil wood was transported from another location (allochtonous) and did not come from forests fossilized *in situ* (autothonous).

All of these essential criteria would be satisfied in a catastrophic scenario simultaneously involving volcanic eruptions, tectonic activity, and flooding of major proportions. The evidence supports just such a swift deposition, charcoalification, and permineralization of this wood.

Gymnosperm Wood Anatomy and Catastrophism

The two silicified and two charcoalified wood specimens which we photographed (Williams *et al*, 1995) all lacked vessels in the xylem. This demonstrates that they were gymnosperms (seed plants without flowers) and not angiosperms (flower-bearing seed plants). The diameter of the xylem tracheids was several times larger than the diameter of tracheids from the wood of pine, a modern gymnosperm. There were virtually no annual rings in these four

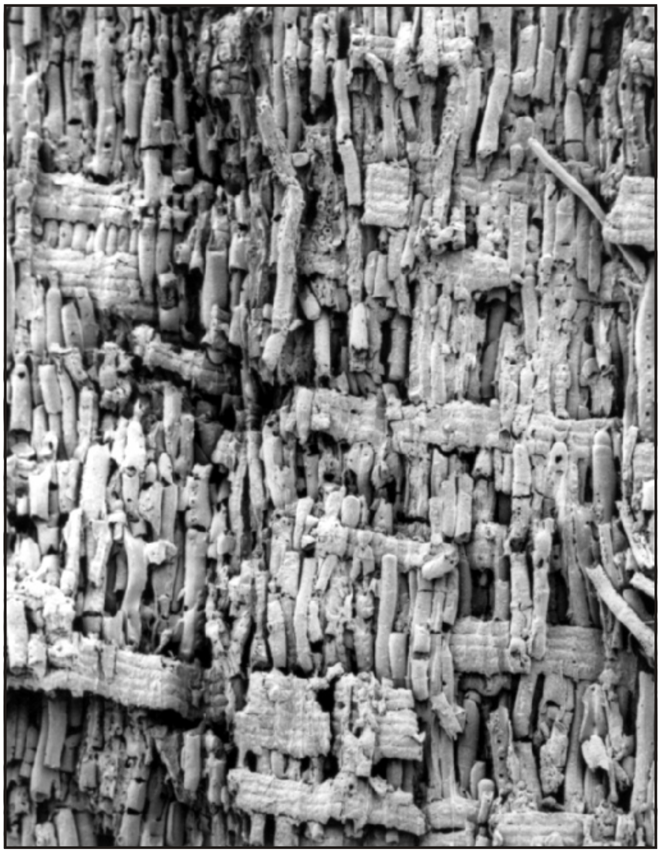

Figure 4a. Scanning electron photograph of fossil charcoalified wood found in the same area as silicified wood (Figure 1). It was 59% carbon. Both tracheids and rays, containing ray parenchema cells, are visible. Magnification is 70x.

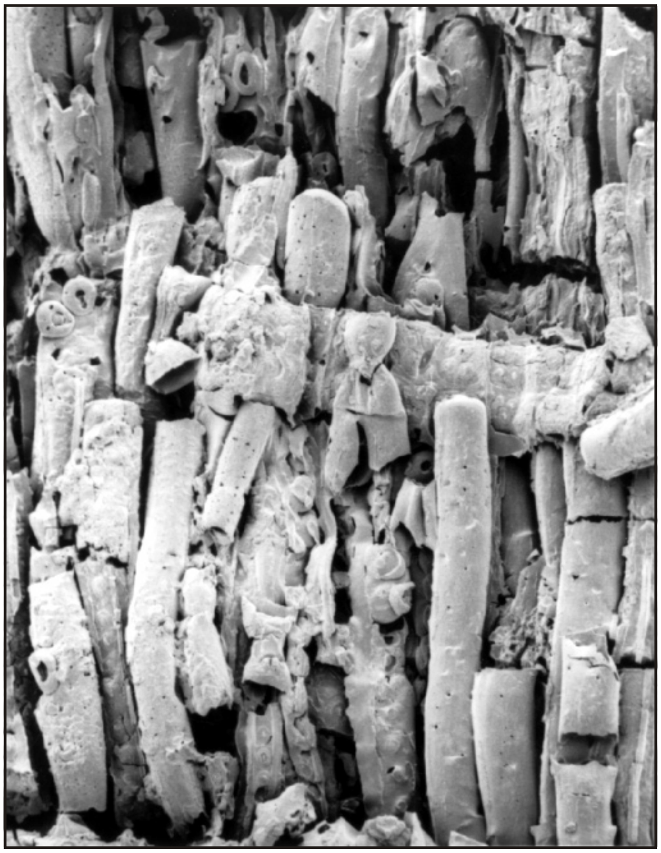

Figure 4b. Closer view of upright tracheids and horizontal ray parenchyma cells from Figure 2a. Magnification is 250x. Pits can be seen to contain small pores which connecting a tracheid with its neighboring cells. The exquiste cellular detail still visible in fossil wood is a tribute to design and later to rapid fossilization.

photographed fossil wood samples, indicating that the trees had developed in a more uniform climate than that which currently prevails in west Texas. Possibly these trees grew in a moderate, pre-Flood environment. The clear cellular detail of the ray parenchyma and xylem tracheids seen in each, suggest further that they were not fossilized slowly (see Figures 1 and 2).

Angiosperm Wood from the Aguja and the Javelina

Wheeler and Lehman (2000) collected, photographed, and identified twelve types of fossil angiosperm wood: eight from the Aguja and four from the Javelina. Thin sections made from samples were compared to known woods in anatomical textbooks, wood collections, and computer databases. The breadth of this research and the precise details visible in their 93 different published photomicrographs are phenomenal.

But such clear definition is also a tribute to the exactitude of preservation in these fossils. Although silicified, they display almost as much structural integrity as can be found in preparations from fresh angiosperm wood. Minutae of parenchyma cells, xylem vessel elements, performation plates, patterns of secondary wall thickening, and pit details, for example, can be easily discerned. This is the apparent consequence of permineralization occurring under proper conditions of catastrophic burial. We also think that the intricacies of xylem anatomy in fossil gymnosperm and angiosperm wood provide testimony to the punctilious microengineering demonstrated by God in producing these plants.

Are the Xylem Vessels of Cretaceous Fossil Angiosperm Wood "Primitive"?

Wheeler and Lehman (2000, pp. 83, 88, and 89) asserted on several different pages that some of their wood samples were "… primitive in the Baileyan sense" (p. 83), because they possessed "…primitive features as defined by the Bailyean trends" (pp. 88–89).

In the first half of the twentieth century, the outstanding wood anatomist I.W. Bailey devised a list of criteria by which one can supposedly deduce the degree of evolutionary "advancement" seen in xylem vessels. For an introduction to this work, consult Bailey (1957). For further

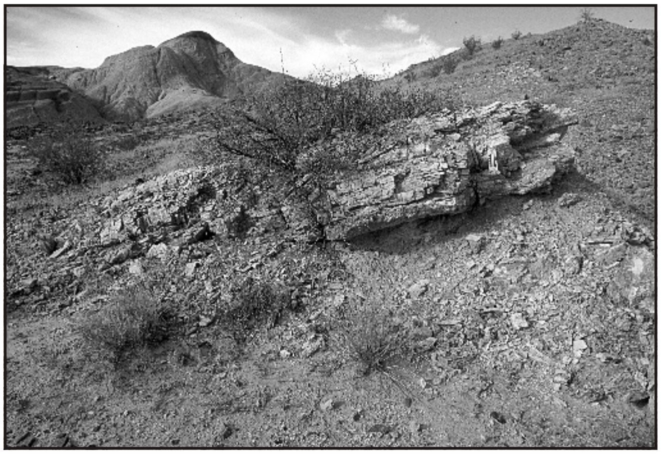

Figure 5. Large petrified tree that contained the termite galleries along its outer surface. There was no indication of any bark, limbs, or root mass, suggesting transport and burial and not *in situ* origin.

analysis of Bailey's origins precepts, lists of his many publications, and an exegesis of his various evolutionary tenets, see textbooks of plant anatomy like Carlquist (1961) and Esau (1953).

It is beyond the scope of this review to examine all of Bailey's dogmas critically, but a careful look at his one basic premise ought to demonstrate the nature of his logic. Underlying all of Bailey's criteria is the foundational presupposition that xylem vessels of angiosperms must have arisen by evolution from the xylem tracheids of their supposed gymnosperm ancestors. By finding out how similar (or dissimilar) the xylem vessels of any plant species are to tracheids, Bailey believed one could discern the degree of evolution from "primitive" (similar to tracheids) to "advanced" (relatively dissimilar to tracheids).

The flaw in Bailey's reasoning is that he assumed what he needed to prove—that xylem vessels had indeed evolved from ancestral tracheids. This has never been demonstrated, and so all of Bailey's phylogenetic dicta are distorted by his having "begged the question"—a logical fallacy know as *petitio principi*, or "assuming what needs to be proved." Hence, aside from all the splendid plant anatomical detail he described, we think his concepts of xylem evolution have little objective value for origins students. Bailey was not alone in embracing the *petitio principi* fallacy; many evolutionists routinely do the same at various points in their argumentation.

As an evolutionist, Carlquist understood the potential for misusing Bailey's pronouncements:

> One must remember that only characteristics, not plants or species, are primitive or advanced. If this principle is kept in mind, phylogenetic hypotheses are likely to be conceived with greater accuracy. Carlquist (1961, p. 7).

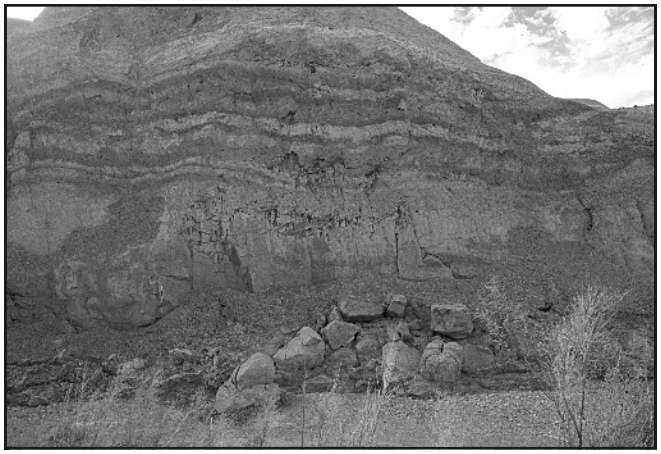

Figure 6. Color banding in clays is more suggestive of diaenetic changes rather than paleosols. Note the concentration of banding toward the surface, with the color banding fading with depth. Perhaps the color banding is a weathering phenomenon, more study is required. Photograph from an exposure along Dawson Creek.

We hold that differences in xylem vessel tubes conform to functional design rather that to evolution. For example, Carlquist pointed out in one instance that a smaller diameter and greater number of vessels per unit area helps prevent damaging air embolisms in conducting channels (Carlquist, 1977, p. 888.) reflecting on Carlquist's data, Howe (1978, p. 71) theorized that "…the water tubes of plants from each ecological zone were fit for life under those particular conditions." We think that differences in xylem vessel anatomy are matters of providence, not phylogeny.

Cretaceous Wood is Actually Contemporary

Wheeler and Lehman (2000, p. 89) reported that their Cretaceous wood samples "…often have a generalized structure that is seen in more than one extant family, order, or even subclass [of angiosperms] …" Just four lines after having called their Baileyan Big Bend Wood Type I "primitive," on page 98, they said that its "… combination of characters is widespread in extent angiosperms, occurring in 14 families … and six subclasses." Such a distinct combination of xylem traits now widely found incorporated in diverse modern taxa points toward design, not evolution; toward the view that Cretaceous wood is "contemporary" in its anatomy, not "primitive." We will soon discuss the possibility that Cretaceous angiosperm wood anatomy was quite well suited for the "Cretaceous" environmental conditions. Concerning the contemporary character of such wood, Bailey (1924, p. 439) remarked that:

> It is a striking and well-known fact that the Angiosperms, from the time they first appear abundantly in the Cretaceous, are highly differentiated and are in

general remarkably similar to their descendants in extant flora.

It is hard to account for this close similarity between fossil wood and many modern woods if these fossil specimens range between 84 and 66 million years old (Wheeler and Lehman, 2000, p. 84). Why has so little change occurred in such a vast time period, one might legitimately ask. One can also ponder why a convincing fossil ancestry for flowering plants in general has never been found.

Reversal of Evolutionary Expectations?

According to the modern synthetic theory of evolution, gene pools are expected generally to become more diverse across elapsed time because mutations originate and then accumulate in the gene pool. This would seem to lead to greater species diversity as eons go by. Yet in their discussion of work done on fossil wood of sycamore family members (Wheeler and Lehman, 2000, p. 94) indicated that "In the past the Platanaceae [sycamore family members] were more diverse [Cretaceous] than at present…"

Stratigraphic Revisions Required

As a result of their research (Wheeler and Lehman, 2000), showed that certain previously held stratigraphic conclusions needed to be modified. Here are some of the changes that are required:

- In the Cretaceous, angiosperm trees were formerly assumed to be quite small. But here the trees were 70 cm in diameter and larger.
- The Cretaceous angiosperm tree flora appear to be much more diverse than was previously thought.
- An anatomically preserved, *in situ*, dicot tree was not known to exist in the Cretaceous. In Wheeler and Lehman (2000), however, several are claimed to have been found and we shall discuss them later in this review.
- The angiosperm order Malvales was not known to exist in the Cretaceous. Yet it is found to be present in strata assigned to the Cretaceous.
- Wood they call *Bombacoxylon* was not thought to exist any farther back than the Paleocene but is identified in the Cretaceous by Wheeler and Lehman. Judging from such modification, it would appear wise not to build any origins theories on the presence or absence of plant species in various stratigraphic levels.

In summary, this research paper (of Wheeler and Lehman 2000) has brought sweeping changes to many stratigraphic notions. One can only wonder what percentage of all stratigraphic generalizations are patently false and just waiting to be struck down when more study is undertaken. Is it possible that stratigraphic generalizations can become hindrances, rather than aids, in advancing historical geology?

Ecological Relationships Mirrored in the Fossils?

Wheeler and Lehman (2000, pp. 83 and 86) found an interesting correlation between certain kinds of fossil angiosperm wood and the remains of particular species of dinosaurs in the Aguja as opposed to the Javelina Formations. They noted that their eight types of Aguja wood were buried with the remains of the duckbill (a hadrosaur), and with the horned *Chasmosaurus* dinosaur (p. 83). At one location in the Aguja, for example, their Bailey's Big Bend Wood Type I was found entombed with hadrosaur remains (p. 98). The four kinds of Javelina angiosperms, on the other hand, were consistently found buried with fossils of a different plant-eating dinosaur, *Alamosaurus*: "*Javelinoxylon* wood occurs at all levels where remains of the giant sauropod *Alamosaurus* occur" (p. 83).

As they point out on page 86, it is possible that this presence of particular herbivorous dinosaurs with certain angiosperm wood types reflects an "ecological relationship" by which they probably mean a feeding preference. But such an interesting discovery may have nothing to do with the vast time differences that have been assigned to the Javelina versus the Aguja Formations. Instead, it may have resulted from the burial of different, coexistent, ecological communities in successively deposited Flood strata. It could possibly represent a record of various life zones fossilized one after another in the same catasrophe.

CO_2, Dinosaurs, and Plant Anatomy

Parenchyma is a simple plant tissue composed of soft walled, storage cells and it is found in many different plant organs. Parenchyma is present in the trucks of trees, especially in horizontally oriented, ribbon-like patches of cells called wood rays (See Figure 3 and Figure 4). Parenchyma cells in the wood remain alive long after nearby vessel elements and tracheids have died.

Wheeler and Lehman discovered that Big Bend angiosperm wood contained a relatively large amount of ray parenchyma tissue. Some of their specimens were 33% parenchyma (percentage by volume), and one particular wood they called *Baasoxylon parenchymatosum* (p.96 and p.106) was 50% parenchyma. They remarked that "One of the more striking features of the late Cretaceous Big Bend dicotyledonous [angiosperm] wood is the abundance of apotracheal diffuse-in-aggregates parenchyma and/or ray parenchyma" (p. 113).

They suggest that this large amount of parenchyma may have been a very fortunate feature because there probably were "… elevated atmospheric CO_2 levels …" (p. 84) in the past. The extra CO_2 would have fostered greater photosynthetic production, with a corresponding need for more storage parenchyma tissue.

Another fortunate consequence of this extra ray tissue relates to dinosaur feeding habits. Ray parenchyma cells are arranged from the center of the stem outward, like spokes in a wheel. They would therefore have afforded greater physical resistance to the sideways tugging on stems by "… intense dinosaur herbivory" (p. 84). The authors thus suggested that the extra parenchyma tissue in these Cretaceous stems "… may reflect a response to elevated Cretaceous atmospheric CO_2 levels, or to intense dinosaur herbivory" (p. 84). They have wisely avoided suggesting any evolutionary mechanism by which the extra parenchyma tissue may have originated. They have allowed their readers to speculate as they wish, such as:

- attributing these favorable amount of parenchyma to the action of natural selection on gene mutations over extended time periods, or
- attributing them to Divine genetic engineering in the creation.

No Annual Growth Rings

As we found with our gymnosperm fossil wood from the Dawson Creek area, their angiosperm wood samples lacked annual rings. In describing all but one specimen, they stated that growth rings were either "absent," "indistinct," or "not observed." Only in the case of *Pageoxylon cretaceum* (p. 93) did they indicate growth rings, and even in that case, the growth rings were "faint".

The authors were puzzled concerning how to reconcile such a lack of growth rings in Javelina wood with "sedimentological evidence" which they thought suggest arid environmental conditions (p. 113). Their speculations about aridity arise from their thoughts about ancient soils called "paleosols". A more obvious conclusion, however, would be that all these angiosperm trees grew in a mild, maybe even humid, seasonless environment.

Paleosols in Big Bend National Park

Extensive work, from a uniformitarian perspective, has been conducted on the purported paleosols within Big Bend National Park (Lehman, 1989; 1990). This work builds on the concept that color-banding of the clays, hardpan layers within the clays, and calcite nodules found in the volcanic ash derived clay layers represent a well-drained delta-plain facies (McBride, 1974). Field experiments conducted on the weathering of a volcanic ash located outside of Jackson, Wyoming has revealed the importance that organic matter contributes to its diagenesis (Antweiler and Drever, 1983). Organic acids break down the volcanic ash and theses acids are believed to be the reason that soil caliche nodules and rhizoliths form in the subsurface (Lehman, 1989). Does the petrified plants and bones, color-banding of the clay layers, occurrence of carbonate hardpan layers and calcite nodules found in both the Aguja and Javelina formations really represent deltaic flood-plain paleosols that existed on Earth millions of years ago or are there other possibilities? Young-earth creation scientists must seek out other interpretations consistent with the data as we lack both the "time" and purported paleosettings suggested by uniformitarians (Froede, 1998).

An interpretation of this setting more consistent with Scripture might be that the original volcanic ash was derived from nearby sources and deposited in subaqueous conditions during the Flood (Froede, 1996). Large volumes of connate water moving through the newly deposited sediments leached minerals that served to enhance the petrifaction of organic materials (e.g., plant materials and dinosaur bones). At a later point during the Flood, the diagenetic alteration of clay minerals could have contributed to the dissolution of carbonate (Wintsch and Kvale, 1994). The dissolved carbonate would have moved with connate water and precipitated due to various pH and Eh changes. The eventual withdrawal of Flood water coupled with likely significant fluctuations in the groundwater table and changes in subsurface geochemistry would have served to precipitate any remaining carbonate at or near various levels of buried organic matter and/or along lithologic contacts within the subsurface. The alteration of the original ash to clay would also result in the multi-colored banding observed within the clay layers today (Figure 6). Within the interpretation, the petrified organic materials, soil caliche carbonate nodules, sheet-like "hardpan" carbonate layers, and color banding found within the Aguja and Javelina formations clearly reflect processes expected during and following the global Flood of Genesis. None of these features support the occurrence of paleosols.

Transported and Deposited versus an In-Place Burial?

At a site in the eastern portion of Big Bend National Park, Lehman and Wheeler (2001) found 18 permineralized tree trunks in a particular stratigraphic horizon of the Aguja Formation. Of the total of 18 specimens, six stumps were observed in an upright position. As the authors stated:

> …six are upright stumps that remain definitely in place, rooted in an underlying paleosol. An additional three consist only of parts of root masses in place (p. 102).

Nine specimens were parts of trunks, "that have been toppled over and displace from original growth positions" (p. 102). Lehman and Wheeler concluded that this fossil assemblage was formed *in situ*. Also they speculated that the trees "… may have died in response to burial by up to a meter of sediment, probably accumulated during a severe flood" (p. 104).

It is quite possible that all 18 specimens are allochthonous in origin. We have previously reviewed the possibility and likelihood of the transportation and burial of fossil trees like these (Williams, 1993, p. 110–111). One of the places where there has been considerable discussion of autochthonous vs. allochthonous burial of wood is at Specimen Ridge in Yellowstone National Park. This was noted in Williams (1993, p. 110):

> Harold Coffin (1976, pp. 539–543) has done considerable work on the Yellowstone petrified forests. In his excellent book *Origin By Design*, he devoted an entire chapter (1983, pp. 134–151) to the subject. He offered evidence that favors the transportation hypothesis against in situ burial. These evidences are categorized as abrupt root terminations, overlapping levels of the tree layers, orientation of vertical and petrified trees, ecological diversity of fossil trees, bands of organic matter in various "soil" levels, arrangement of the organic matter in the levels, evidence of water sorting, type of organic matter in "soil" layers, geochemistry of layers, nature of the sediments in which the trees are contained and a discussion of the vertical flotation of trees. Interested readers should consult this treatise. Also since the petrified forests are preserved in a National Park, they offer research opportunities for creationists interested in this topic.

Coffin (1983, pp. 117–133) also discussed the classic Joggins petrified trees and conducted experiments on trees that float upright with intact root systems. He then listed 10 evidences for allochthonous origin of upright fossil trees. Coffin then noted: "Geologists have uncritically taken upright trees as *a priori* evidence of unchanged growth positions, but it is best to be cautious about such an automatic assumption" (pp. 126, 127). He further stated that:

> … Stevenson (1911–1913) in his monograph in the formation of coal beds decided that upright trees are not important in settling the problem of autochthonous or allochthonous origin of coal (p. 127).

Steve Austin (1986, p. 4) in his work on the Mount St. Helens explosion of 1980, discussed finding upright deposited logs in Spirit Lake. As he noted (p. 4):

> The landslide-generated waves on Spirit Lake stripped the forests from the slopes adjacent to the lake and created an enormous log mat…. Careful observation of the floating log mat indicates that many trees float in upright position with a root ball submerging the root end of the trunk while the opposite end floats out of the water… These trees if buried in sediment, would appear to have been a forest which grew in place over hundreds of years…

Also Austin related the results of sidescan sonar and scuba diving work in surveying the lake bottom (p. 4).

> Hundreds of upright, fully submerged logs were located… Extrapolating from the small area of lake floor surveyed to the entire lake bottom, we estimate more than 15,000 upright stumps existed on the floor of the lake in August 1985. The average height of an upright deposited stump is 20 feet. Sonar records and scuba investigation verified that many of the upright deposited trees have root masses radiating away from the bases of the trunks.

In this discussion, we do not intend to demean the work of Lehman and Wheeler. We think that what they have examined, however, were trees that had been uprooted and deposited by Flood water, then to be covered and permineralized under silica-rich material. This shows that the very same empirical data can be used to support long ages or rapid flooding based on the set of presuppositions with which one starts.

Fossil Pollen at Big Bend

Baghai (1994) published the results of extensive pollen and other microfossil analyses performed on 40 samples taken from various stratigraphic levels in the Aguja formation. These samples came from Rattlesnake Mountain, which is southeast of the Dawson Creek area. Microfossils from 112 genera of plants were identified in his study, including 36 fern genera, 11 gymnosperm genera, and 43 genera of angiosperms. These microfossils suggest that when the Aguja strata were being deposited, there possible were forests of great species diversity nearby, perhaps pre-Flood forests, unlike the desert ecosystems of today.

Fossil Pollen and Proported Environmental Settings

In a summary table (pp. 64–65) Baghai listed an "Environmental setting" and various "Comments" for 30 of these microfossil samples. A few examples of the environmental settings that these samples supposedly indicated were "Coastal floodplain swamp," "Lower deltaic coastal swamp (minor marine transgression)," "Fluvial continental floodplain," "Deltaic coastal floodplain swamp," etc. (p. 64). Baghai assumed that each of these 30 samples correlated with gradual, long-term deposition within a stable paleoenvironment.

The author's comments concerning the presence of microfossils in the various samples were somewhat vague and subjective as seen here:

> fewer, few, some, copious, occasional, abundant, numerous, dominated by, sparse, some, diverse, large quantities of, etc.

From data such as these, it is not clear how Baghai was able to deduce the very specific stratigraphic paleoenvironments listed for each of the 30 samples reported. If in fact Baghai and others who believe in paleoenvironments that changed gradually over long periods of time want to convince skeptics, they will need to develop quantitative methods that are taxonomically more precise. That task, however, might be daunting since it would necessitate determining the numbers of each species of microfossil per unit volume, for each and every sample. A comment like "assorted genera of angiosperms" is hardly the information required to conclude, as Baghai did, that the particular environment was "marginal marine to brackish, possibly lagonal." To draw such precise conclusions, one would need to know which angiosperms were found and in what numbers for that sample. Paleoenvironmental speculations are replete with assumptions.

Even the underlying concept that these deposits each arose gradually in a stabilized microenvironment is itself questionable because the Aguja and Javelina wood fossils are allochthonous in origin. But if we assume that the pollen-based, putative environments have some measure of validity, it is well to note how regularly they indicate water-related paleoenvironments by uniformitarian interpretation:

- marginal marine to near shore/inner shelf
- freshwater to coastal flood plain swamp
- flood plain
- lower deltaic coastal swamp
- high coastal flood plain swamp
- fluvial-deltaic flood plain
- fluvial continental flood plain
- fluvial levee on lower delta
- minor marine influences from high tides and storm action
- marine regression
- continental floodplain
- marginal marine….etc.

Big Bend Pollen and Catastrophism

If the time scale is shortened and speculations about slow deposition are abandoned, most of Baghai's depositional phenomena would find some reasonable position in a Flood-related origins model. It is possible thus to reinterpret these microfossil data in a catastrophic context. The results appear to support several rapid transgressions and regressions during the Flood event, as we proposed in Williams and Howe (1993). We speculate that these microfossils came from pre-Flood forests.

Various Baghai sample assays contained such items as fragments of carbonized wood, charcoal, leaf cuticles, and oxidized plant materials, all of which fit with catastrophic depositional processes. Further study of microfossils at Rattlesnake Mountain and many other Big Bend localities ought to provide the additional data required to bolster the speculations on one side or the other of the origins question. Meanwhile it is quite obvious that the data from fossil pollen and fossil wood research at the Big Bend fit very well with a Flood Catastrophe Model.

We welcome other researchers to carry out further work on fossil wood and pollen at the Big Bend Nation Park. Such studies might entail identifying all of the gymnosperm specimens that we have previously collected. More collecting needs to be done in an attempt to characterize the nature of what we consider to be pre-Flood forests. And several comprehensive reviews of the vast body of existing data on fossil wood and pollen are needed from the catastrophic, Flood-geological vantage. *Soi Deo Gloria.*

References

CRSQ: *Creation Research Society Quarterly*.

Antweiler, R.C., and Drever, J.I. 1983. The weathering of as late Tertiary volcanic ash: Importance of organic solutes. *Geochimica et Cosmochimica Acta* 47:623–629.

Austin, S.A. 1986. Mount St. Helens and catastrophism, *Proceedings Of the First International Conference on Creationism*, Volume I, pp. 3–9. Creation Science Fellowship Pittsburg, PA.

Baghai, N.L. 1994. Classification and analysis of palynomorphs of the Aguja formation (Campanian), Big Bend National Park, Brewster County, Texas. *Transactions of the Gulf Coast Association of Geological Societies* 54: 63–70.

Bailey, I.W. 1924. The problem of identifying the wood or Cretaceous and later dicotyledons: *Paraphyllanthoxylon arizonense*. *Annals of Botany* 38:439–452, with plate.

———. 1957. The potentialities and limitations of wood anatomy in the study of phylogeny and classification of angiosperms. *Journal of the Arnold Arboretum* 38:243–254.

Carlquist, S. 1961. *Comparative plant anatomy*. Holt, Rinehart, and Winston. New York.

———. 1977. Ecological factors in wood evolution: a floristic approach. *American Journal of Botany* 64: 887–896.

Coffin, H.G. 1976. *Origin by design*. Review and Herald Publishing, Washington, D.C.

Esau, K. 1953. *Plant anatomy*. John Wiley and Sons. New York.

Froede, C.R., Jr. 1994. Fossil wood of Big Bend National Park. *CRSQ* 30:187–189.

———. 1996. Evidence of catastrophic suaqueous physical processes at Goat Mountain, in Big Bend National Park, Texas, U.S.A. CRSQ 33:115–126.

———. 1998. *Field studies in catastrophic geology*. Creation Research Society Books. St. Joseph, MO.

Howe, G.F. 1978. Do plant vessels vary with climate? A plumbing problem. *CRSQ 15:71–72.*

Lehman, T. M.. 1989. Upper Cretaceous (Maastrichtian) paleosols. *Geological Society of America Bulletin* 101: 188–203.

———. 1990 Paleosols and the Cretaceous/Tertiary transition in the Big Bend region of Texas. *Geology* 18:362–364

Lehman, T.M.and E.A. Wheeler. 2001. A fossil dicotyledonous woodland/forest from the Upper Cretaceous of Big Bend National Park, Texas. *Palaios* 5:102–108.

McBride, E.F. 1974 Significance of color in red, green, purple, olive, brown, and gray beds of Difunta Group, Northeastern Mexico. *Journal of Sedimentary Petrology* 44:760–7733.

Stevenson, J.J. 1911–1913. Formation of coal beds. *Proceedings of the American Philosophical Society* volumes 50–52 (as listed in Coffin 1976).

Wheeler, E.A. and T.M. Lehman. 2000. Late Cretaceous woody dicots from the Aguja and Javelina Formations, Big Bend National Park, Texas. *International Association of Wood Anatomists Journal* 21:83–120.

Williams, E.L. 1993. Fossil wood from Big Bend National Park, Brewster County, Texas. Part II—Mechanism of silicification of wood and other pertinent factors. *CRSQ 30:106–111.*

Williams, E.L., and G.F. Howe. 1993. Fossil wood of Big Bend National Park, Brewster County, Texas. Part I—geologic setting. *CRSQ* 30:47–54.

Williams, E.L., G.F. Howe, G.T. Matzko, R.R. White, and W.G. Stark. 1995. Fossil wood of Big Bend National Park, Brewster County, Texas. Part IV—wood structure, nodules, paleosols, and climate.*CRSQ* 31: 225–232.

Williams, E.L., G.T. Matzko, G.F. Howe, R.R. White, and W.G. Stark. 1993, Fossil wood of Big Bend National Park, Brewster County Texas. Part III—chemical tests performed on wood. *CRSQ* 30:169–176.

Williams, E.L., R.L. Goette, W.G. Stark, and G.T. Matzko. 1998a. Fossil wood from Big Bend National Park, Texas. (Dawson Creek Region): Part V—origin and diagenesis of clays. *CRSQ* 35:31–38.

Williams, E.L., and R.L. Goette. 1998b. Trace fossils in petrified wood Big Bend National Park, Texas. *CRSQ* 35: 93–95.

Wintsch, R.P., and Kvale, C.M. 1994. Differential modility of elements in burial diagenesis of siliciclastic rocks. *Journal of Sedimentary Research* A64:349–361.

Book Review

Darwin, His Daughter and Human Evolution by Randal Keynes
Riverhead Books, New York. 2002, 384 pages, $28

This book gives considerable "inside information" on the life of Charles Darwin. The London author is a great great grandson of Charles with access to private papers. An honest picture is given of Darwin's troubled life, including an unknown chronic illness. His unsuccessful *hydrotherapy* treatments, popular in the 1800s, are described in detail.

Darwin was a family man who enjoyed his ten children. Along the way he carefully tabulated their emotions and development (p.62). But the Darwin family also suffered great pain.The book centers on the second born, Annie Darwin, a great joy to her parents. However, Darwin watched Annie's health decline, resulting in her death in 1851 at age 10, probably from tuberculosis. Seven years later the youngest child, Charles Waring, born with Downs Syndrome, died of scarlet fever at age 2. In 1876, a daughter-in-law died giving birth to the first Darwin grandchild (p.305). Such tragedies were not unusual in Darwin's day: 1/5 of newborns died during their first year. However, Charles was greatly saddened by these family deaths. He could not understand why God permitted such suffering. As he abandoned the Christian faith, he wrote "disbelief crept over me at a very slow rate, but was at last complete" (p.136).

Darwin obviously had an insufficient view of the curse or Fall of mankind. Other writers have described how this *problem of evil* led naturally to Darwin's acceptance of evolution theory (Hunter, 2001). Darwin concluded that undirected chance ruled nature with cruel competition for existence between living things. During all his adult years Darwin was not without a positive example. His loving wife (and cousin) Emma was a godly woman of faith. She challenged Charles to trust in the Creator but he declined and called himself an agnostic (p.308). After the death of Annie, Charles still walked his family to church on Sunday but no longer entered the door (p.243). This book causes one to have a measure of pity for Darwin's personal pain and also for his misguided legacy of evolutionary error.

Reference

Hunter, Cornelius. 2001. *Darwin's God* Brazos Press, Grand Rapids. This book was reviewed in *CRSQ* 38(3): 125–126.

Don DeYoung
DBDeYoung@Grace.edu

Letters to the Editor

The Improbable Same-Site Reappearance of the Tigris-Euphrates River System

Woodmorappe (2002) has presented an argument for the *possibility* that the modern Tigris and Euphrates Rivers actually approximate their antediluvian positions. I believe he has succeeded in this task. His primary line of reasoning is the presence of deep-seated faults that govern depocenters and the courses of major rivers. This is a succinct statement of the obvious. Years ago, geologist David McQueen pointed out to me that virtually all valleys are strata-controlled or fault-controlled. In general, small faults result in small valleys, large faults in large valleys. Water runs where the topography dictates. There is nothing new here.

There are some special conditions that would have been necessary for Woodmorappe's possibility to have actually happened:

- The present Tigris-Euphrates basin must have been a continental environment in antediluvian times.
- The antediluvian Tigris-Euphrates basin must have been geometrically somewhat similar to the modern one.
- Tectonic movements must have followed the sequence he outlined to produce the depositional basin and then rise above sea level while remaining below surrounding highlands.
- Noah and his family must have encountered these rivers and applied these names to these same rivers rather than applying the names to other rivers or other names to these.

The first of these points is an assumption that many will be comfortable making. In general, rock density differences between sialic-dominated continental crust and mafic-dominated oceanic crust are believed to preserve the continents in that they isostatically "float" on the mantle above the level of oceanic crust. Was this true of the antediluvian world? No one knows. Nor is it certain that modern Iraq represents part of a stable antediluvian continent.

The second of these points I would venture is possible but very improbable. As other diluvialists have noted (Molén, 2000, p. 248; Morris, 1976, pp. 89–90), the reference of Genesis 2:10–14 seems to indicate a division of four rivers, two of which bear the names Tigris and Euphrates. These appear to have run from Eden in various directions, since three different countries are named through which three of the rivers ran, though azimuths are not given. This is an hydraulically improbable arrangement except where a significant decrease in gradient occurs, as is typical of river deltas in modern environments (forming distributaries). It appears necessary for a very large spring to have fed these four rivers, the source being unknown. With a common source, the two rivers with modern names would probably have rapidly joined if they were following a topographic low in a single graben; they would not have justified two names and a designation as separate rivers.

The third point seems possible. Evidence of episodic vertical motion on faults, especially deep-seated faults, is very common. Whether the faults bounding the Mesopotamian graben meet the necessary conditions to satisfy the requirements of this historical scenario I am in no position to say. From the information presented in Woodmorappe's paper, it appears possible. Of course, movement along these faults could just as easily have produced a horst and a resulting mountain range.

Woodmorappe also argues that Noah's ark may have drifted in the general vicinity and landed not so very far from the point whence it disembarked, which would satisfy the fourth condition listed here. This scenario appears partly motivated by the thought that the Middle East forms a particularly strategic center of modern continents for either gathering or dispersing land animals. Such a scenario is not required by plate tectonics or by some other natural history scenarios, but it would be significant to a fixed-continent model. It is also unlikely. I do not differ with Woodmorappe in his postulate of divine guidance to the region of Ararat at the end of the Deluge; however, I remain thoroughly unconvinced that there was anything "theologically special" about this region before the global flood cataclysm. For all we know, it may have been a sea. Some other place on earth may then have been more suitable to the divine gathering of animals. That the ark may have drifted many thousands of miles can be demonstrated. Barnette and Baumgardner (1994) showed that extremely strong currents would naturally develop rather rapidly on the global ocean. Even without the work of Barnette and Baumgardner, one would have a hard time convincing a beachcomber of such a short voyage as Woodmorappe posits–short of the miraculous, naturally, and for that we have no Scriptural record.

Woodmorappe seems to think the Najd fault system may be unique. That is clearly an unproveable thesis, but it can certainly be disproven if other similar fault systems are located. It may well be that some have been. I am not familiar with the Najd system and cannot, therefore, determine whether deep fault systems in Greenland, in Montana, or in other places are comparable. This may be worth researching.

In conclusion, Woodmorappe's point that the modern Tigris and Euphrates *may* occupy roughly the same positions as they did in antediluvian times appears sound. However, I consider it very, very unlikely. The common belief of diluvialists that these names arose in much the way that York, Pennsylvania; Lancaster, California; or Malta, Montana, were named appears much more likely.

References

Barnette, Daniel W., and John R. Baumgardner. 1994. Patterns of ocean circulation over the continents during Noah's Flood. *In* Walsh, R.E. (editor), *Proceedings of the third International Conference on Creationism*, pp. 77–86. Creation Science Fellowship. Pittsburgh, PA.

Molén, Mats. 2000. *VDrt ursprung?* [Our origin?]. XP Media, Haninge, Sweden.

Morris, Henry M. 1976. *The Genesis record*. Baker Book House, Grand Rapids, MI.

Woodmorappe, John. 2002. The feasible same-site reappearance of the Tigris-Euphrates river system after the global flood. *Creation Research Society Quarterly* 39: 106–116.

Peter Klevberg, B.S., P.E.
512 Seventh Avenue North
Great Falls, Montana 59401

Tigris-Euphrates River System: A Reply

Mr. Klevberg and I are in substantial agreement about almost every issue that he has raised. No doubt that, were the Ark moved around the Earth in completely free and random manner, it would be quite improbable for it to have landed within reasonable distance from where it was launched. But the fact of the matter is that we simply do not know the net movements of the Ark during the Flood. In fact, this is probably not even knowable (this side of eternity anyway).

Apropos to this, I believe that it is much more fruitful to consider things that can be known (geology) than to be hindered by speculations that cannot be resolved (net travel distance of the Ark). We should examine the world's geology on its own merits. And it is this very examination that leads to the striking fact that much of the Phanerozoic (Flood-deposited) strata parallels the present Tigris-Euphrates valley. This is what leads to the serious consideration that the antediluvian Tigris-Euphrates River and its modern counterpart were and are located at nearly the same geographic location. There is no requirement for the Najd fault system to be absolutely unique on Earth. Neither is there any need for the antediluvian and postdiluvian rivers to have been exactly alike, and there has been much speculation about the identity of the two other rivers (tributaries?) mentioned by Klevberg. The fact that large river systems, far from being merely surficial features, tend to be controlled by deep-seated geologic features force us to re-examine the Tigris-Euphrates River system in this new light.

John Woodmorappe
6505 N. Nashville #301
Chicago, IL 60631-1724

Infallibility and Order in the Fossil Record: A Response to Edward C. Lain

In his response to Dr. Reed, Edward Lain (2002) appeals to support from extra-biblical documentation such as the book of Jashar. He defends his appeal by observing that the Bible itself cites the book of Jashar. This logic does not follow. The Bible is inspired by God and is inerrant, so if a Bible text cites a *particular point* from another literary source then we may be assured that literary source is correct on that point. But it is erroneous to assume that this means that everything else in the extra-biblical source is infallible. Lain cannot claim blanket infallibility for an extra-biblical source just because the Bible cites it on one point. The "weight" given to it by the authors of Joshua and II Samuel is really quite irrelevant, for God may have selected one accurate point from the book of Jashar amid a multitude of errors. Or must we also accept Epimenides as infallible? (Titus 1:12–13)

Lain also writes:

"…Dr. Reed has just blown his flood geology model out of existence. He freely admits that the fossil record does have order in it and that it is not random. If the entire geologic record had been the result of Noah's flood, it is hard to see how there would be such precise fossil order, in fact, any fossil order. It would all be random… The whole thing would be random and mixed up."

Lain repeats a common error made by anti-creationists, that a catastrophic global Flood would necessarily result in disordered fossil deposits. This false premise is founded upon confusion over the difference between erosional energy (on the one hand) and depositional conditions (on the other).

It is apparent that high levels of energy (in the form of motion of water, etc.) are required to achieve large amounts

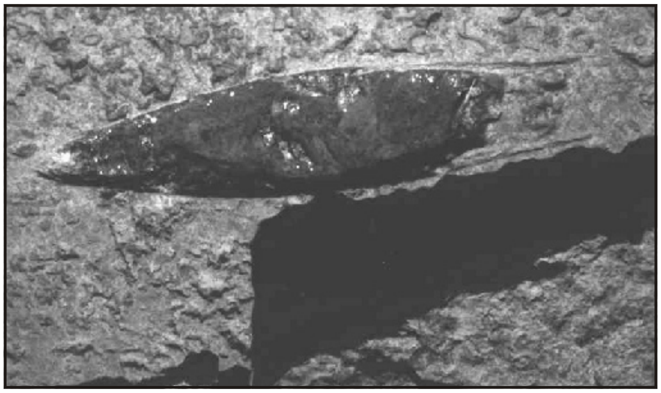

Figure 1. Mid-sized nautiloid fossil, Hook Island, Ontario. Length approximately 50 cm.

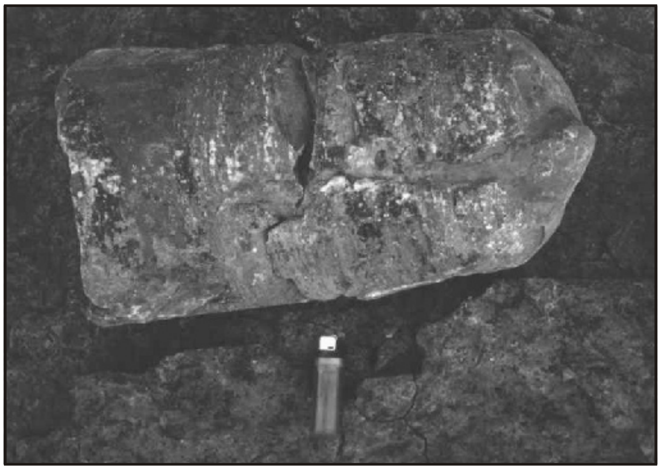

Figure 3. Large conic sections of nautiloid shell washed up on shore, Hook Island, Ontario. Lighter for scale.

of erosion during the Cataclysm. This would likely also involve a high degree of turbulence, which might initially produce the disorder Lain expects. However deposition of fossils (and rock strata generally) would not occur at this point precisely because of the high energy level.

Only when energy levels subsided would deposition of strata dominate over erosion. The energy of Floodwaters could disperse in two ways: instantly or gradually. Where instant, as in a wave of water striking against a cliff, turbulently disordered fossil deposits might result.

However, by far the more common form of deposition would be under conditions where energy dispersion was at least somewhat gradual. As the energy levels decline sorting of sediments and of fossils carried in the mix will result. The experiments of Guy Berthault *et al* (Snelling, pp. 125–126) prove that sediment sorting can occur quickly. The very fact that sediments from rapidly deposited strata such as turbidites are sorted shows that sorting of materials carried in suspension by Floodwaters would occur during the Cataclysm.

The problem for uniformitarians is that the sorting of fossils in the fossil record goes too far, beyond what would be explained by evolutionary succession. For example, near the towns of Arkona and Thedford, Ontario, are found distinct varieties of fossil *Mucrospirifers* dubbed *arkonensis* and *thedfordensis* respectively, the former having a wider shell than the latter (Southworth, 1967). Are we to believe only fat, stubby *Mucrospirifers* lived in one epoch and wide, slender *Mucrospirifers* lived in another? If so why do we find their fossil remains in such close association only a few kilometers apart? If they evolved over long periods of time we would expect to find the distinct populations more widely dispersed geographically. More likely water currents sorted a mixed assemblage of the fossils such that one type began dropping out of the Floodwaters a short time before the other type.

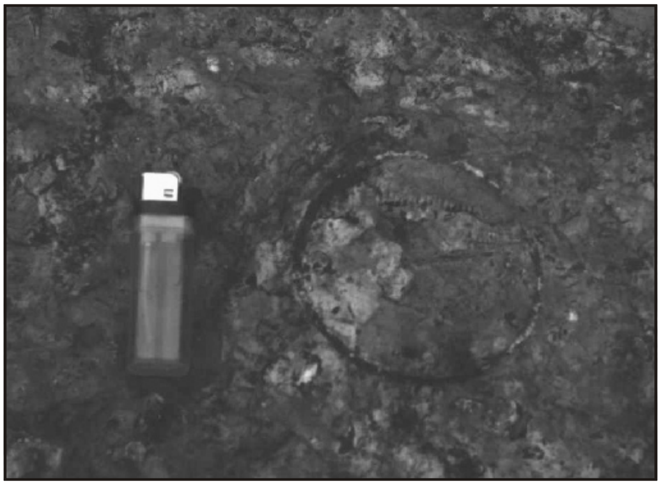

Figure 2. Cross-section of nautiloid shell with small nautiloid in upper portion. Lighter for scale.

Near Hook Island in the North Channel of Lake Huron I have observed an even more impressive example of sorting. In a flat pavement-like area of rock level with the lake one can observe significant numbers of mid-sized (40–60 cm.) nautiloid shells [Figure 1]. Almost no other fossils of any species are present in this layer.

Immediately above this layer one observes rocks with a scattering of very small nautiloid shells (<10 cm.), and a complete absence of the mid-sized nautiloid shells apart from one tilted vertically and exposed in cross-section, with a smaller specimen *within* the shell [Figure 2]. From this I infer that the mid-sized specimen was an empty shell from a dead nautiloid before the Cataclysm, and being lighter it only came to rest later and in a different orientation than its more recently deceased comrades. It then entrapped other materials still in the moving water such as the smaller nautiloid. Like the layer below it species diversity in this strata was very low.

On the lakeshore I made one other discovery. Cast up on shore by wave action I found two sections of rock about three meters apart that fit perfectly when assembled together [Figure 3]. These were sections of a much larger nautiloid shell with at least twice the dimensions of the mid-sized specimens on the shoreline. It had apparently broken out of rock strata below the waterline.

What did I make of these observations? A strict uniformitarian would have me believe that the large nautiloids evolved first and then became smaller over time, with only adult nautiloids (not any of their young) recorded in the lower strata! Strict uniformitarians further have to believe that these nautiloids existed in seas strangely lacking any kind of functional ecosystem, harboring little other life.

In my fossil collecting it is abundantly apparent that low species diversity is the rule rather than the exception. Evidence of hydraulic sorting activity is frequently observed. It is worth noting that the general order of terrestrial life found in the fossil record (amphibian-reptile-mammal-bird) was replicated by Dr. Leonard Brand in a sorting experiment (Brown, 1995, p. 141), something that would be predicted neither by Darwinism nor by the ecologically-focused CCC model.

I propose that all the nautiloids at Hook Island collectively were sorted into a distinct grouping (based on shape) that was largely segregated from other contemporaneous forms of life from the same habitat. It is apparent that the largest and heaviest nautiloids dropped out of Flood currents first, then the mid-sized ones, and finally the smallest ones. One is not required to believe the CCC model to adopt this interpretation.

In summary, a correct understanding of energy levels during the Flood and their sorting effects leads to the following predictions: (1) sorting of fossils will generally be beyond what would be expected due to sorting by habitat or time (evolution); (2) there will be low species diversity in most fossil deposits due to hydraulic sorting; (3) turbulent deposition and resultant fossil disorder will be the exception and not the rule, occurring primarily where there is evidence of rapid energy loss in the sediments themselves.

References

CRSQ: *Creation Research Society Quarterly*

Brown, Walter. 1995. *In the beginning*. Center for Scientific Creation, Phoenix, Az.

Lain, Edward. 2002. Flood geology model versus the CCC model: A response to John K. Reed. *CRSQ* 39: 137–139.

Snelling, Andrew. 1997. Sedimentation experiments: Nature finally catches up! *Creation Ex Nihilo Technical Journal*11:125–126.

Southworth, Charles. 1967. A *guide to the fossil bearing areas of Arkona, Thedford and Vicinity*. Lambton County Historical Society, Petrolia, Ontario.

Eric Blievernicht
940 E. Sunset Pike
Terre Haute, IN 47802
Ebliever@earthlink.net

Gradualism and Catastrophism are not Scientific

The article by John K. Reed, “Reinventing Stratigraphy at the Palo Duro Basin,” printed in the June 2002 issue of the *Creation Research Society Quarterly* (*CRSQ*) pp. 25–39 has moved me to write this letter. While I question some of the assumptions, interpretations, and graphs of this article, they are beyond the scope of this letter and demand further research. I would like to express my general concern about articles of this type that frequently appear in the *CRSQ*.

Here is my concern. Near the beginning of this article Reed writes, “Our difficulties begin to be resolved by recognizing that natural history is a subset of history, not science (Reed, 2001)”. Does he follow his excellent advice? No, instead he writes a paper suggesting an alternative interpretation to the more common, gradualistic or, as he calls it, uniformitarian interpretation usually found in articles on stratigraphy. He takes the same geological observations but interprets them using an augmented version of the Genesis Flood to produce a different scenario for the origin of the rock strata of the Palo Duro Basin. In other words, he wrote a nonscientific paper which as geology editor he saw fit to publish in one of the world’s leading creationist scientific journals. I do not get it. When are geologists going to stop falling for the temptation to try to explain how the earth as a whole and specific places in particular came to have the rock strata they have? When will the abandon this vain search for the unverifiable? Christian creationists ought to heed what is written in Job 38:1–5:

Then the LORD answered Job out of the storm. He said: “Who is this that darkens my counsel with words without knowledge? Brace yourself like a man; I will question you, and you shall answer me. Where were you when I laid the earth’s foundation? Tell me, if you understand. Who marked off its dimensions? Surely you know! Who stretched a measuring line across it?” NIV

Reed correctly rejects interpreting the rocks of the Palo Duro Basin using the naturalistic, uniformitarian principle in gradualistic fashion to attribute great age to most of the rock record of the Palo Duro Basin. Yet he does not reject naturalism. In this article he tries to explain, or interpret, the rock record of the Palo Duro Basin in natural, albeit, catastrophic terms. For example, on page 30,

> I believe the marine waters of the Flood covered this area quickly … As water (a natural compound) covered (flooded, a naturally occurring phenomenon) the area, carbonate deposition (a natural process) rapidly overcame classic depostion (a natural

> process). This could have … (3) a significant geochemical (natural) impetus toward carbonate precipitation probably caused by hearing and CO_2 degassing of the upwelling marine waters.

I submit that this is not a creationist explanation. This is a theistic-catastrophic explanation based on theistic uniformitarianism where "geologic energy," a non quantified measure, is substituted for time.

By the way, Reed's Figure 7 on page 36 seems to violate the first law of thermodynamics. Am I wrong? It shows a major input of energy at the onset of the Food and a minor increase midway through the Flood. Where is that energy coming from? It seems to me if creationist theories violate a well documented law of nature, we have lost our best reason for not accepting mega-evolutionary theories.

His explanation of how the rock record of the Palo Duro Canyon came to be is as unsatisfying as a theistic-evolutionary explanation on how life as we know it appeared on this earth. I am glad that I, as a self proclaimed scientist, do not have to choose between these two incredible, non-scientific, historical theories. I can choose to believe that God the Father, Almighty, created the heavens and the earth and still preserves them.

I do not fault John Reed and his peers. I fault their mentors and myself. I have been reading articles written by their mentors for more than 30 years, and lately, those written by this generation of creationist geologists without giving any feedback. Thus I fear my silence has implied agreement. Please permit a short digression. Some thirty years ago I was forced to read Preston James, a respected member of the geographic profession. He described "Environmental determinism," a false notion used at the time to explain many geographic facts, as a "deviant stream." He claimed that it was taking geography down to a dead end and that it had to be discarded if geography as a profession was to advance. He identified a false idea and gave it a name. This fostered communication among geographers which over the course of time put academic geography back on the right track.

As a proud member of the creationist movement, I would like to suggest that scientific creationist may be following a "deviant stream," as they attempt to combat a belief in an ancient earth. I see the attempt to use an augmented Genesis Flood as the mechanism God used to create much of the sedimentary rock strata of the earth as a "deviant stream." It causes scientific creationists to become paleohistorians. I like to refer to them as writers of science fiction because they have to extrapolate present day scientific knowledge backward instead of forward to create their scenarios. It causes Reed and others to invent incredible scenarios such as this one found in the article under discussion where on average 25 to 50 feet of carbonate sediment per day had to be precipitated in order to create the rock record of the Palo Duro Basin. The gradualistic approach is little better. Gradualists have the rock being deposited at an average rate of around 0.0003 inches per year.

Let us face the fact that God, the creator, did not tell us how or when he created the rock strata of the earth. He does say that it shows forth His glory (Psalm 19:1 or Psalm 148:1–13). When we scientific creationists attempt to tell the world how He did it we are attempting to glorify ourselves rather then glorifying God.

Furthermore, in the "Notes From the Panorama of Science" section of the June 2002 (*CRSQ*), p.55, John K. Reed and John Woodmorappe criticize positivists who affirm belief in the Bible with the words, "but we find it [his belief in the Bible] is always in his own warped exegetical terms, with science driving interpretation." I find this a case of the pot calling the kettle black. Reed and Woodmorappe and other Flood geologists have their own warped exegetical interpretation of Genesis 6, 7, and 8. For whatever reason they read into this account all sorts of violent geologic activity and insist that a world-wide Flood was not a big enough catastrophe to "put an end to all people, for the earth is fill with violence because of them.." … "to destroy both them and the earth" Genesis 6:1. Furthermore I believe that in Genesis 7:21–23 God explains what the Flood did.

> Gen. 7:17–23 For forty days the flood kept coming on the earth, and as the waters increased they lifted the ark high above the earth. The waters rose and increased greatly on the earth, and the ark floated on the surface of the water. They rose greatly on the earth, and all the high mountains under the entire heavens were covered. The waters rose and covered the mountains to a depth of more than twenty feet. Every living thing that moved on the earth perished—birds, livestock, wild animals, all the creatures that swarm over the earth, and all mankind. Everything on dry land that had the breath of life in its nostrils died. Every living thing on the face of the earth was wiped out; men and animals and the creatures that move along the ground and the birds of the air were wiped from the earth. Only Noah was left, and those with him in the ark. NIV

The purpose of the Flood was to destroy the people of the earth and the violence found in the earth because of them. Nowhere in this account are other geological processes invoked to destroy mankind and the violence that filled the earth because of mankind. I believe the reason these additional catastrophes are read into the Genesis account is so that "Flood geologists" can give a "scientific" interpretation of the rock strata of the Palo Duro Basin and other such places. To demand that the Flood was accompanied by these additional catastrophes is an example of "warped exegetical terms with science driving interpretations."

I believe that "augmented Flood geology (by which I mean the adding of extra-Biblical catastrophes to the Genesis Flood) is a deviant stream and will not, in my opinion, help the creationist cause. Scientific creationists must continue pointing out how the processes found in nature, processes that have been discovered by scientific research, cannot explain how the universe and its life forms originated. Their job is to debunk for the nonscientific community the false interpretations of these origins that are taught as if they were facts. This is what the nonscientific trained public needs to counteract the incredible histories they are being asked to believe by secular humanists today. They do not need scientific creationists telling them how their omnipotent Creator used a catastrophe designed to destroy to explain how things we find today came to be. Flood geologists may find this fun and intellectually challenging. It may fulfill their desire to share their scenarios with like minded people but it will not convince the unbeliever nor will it glorify our Creator. It may in fact have the opposite effect on those in the scientific community with whom we disagree.

Ted Aufdemberge, Ph.D.
Prof. of Geography and Earth
Science, Retired
Concordia Univ.–Ann Arbor
9020 Gross Road
Dexter, MI 48130

Lack of Rigorous Analysis of the CCC Model

I was reading the continuing controversy surrounding Gentet's CCC model and noticed the following:

> The point is that the CCC geological model at least allows for the possibility that in the long, pre-Flood times glaciers could have also existed and left their mark. The Flood Geology model does not allow such a [sic] possibility in flood deposits. Any impartial evaluation of alleged glacial remains is therefore [sic] impossible with the Flood Geology model (Gentet, 2002, p. 142).

It seems to me that when you initiate a new model it should be the result of long study and the weighing of what has previously been written. Neither Gentet nor Lain, however, has referred to work that I performed on the question of pre-Pleistocene glaciations and the Flood (Oard, 1994; 1997a). Previously, Mats Molen (1990) addressed the subject that these "glacial" deposits show evidence that they are the result of submarine landslides and not glacial deposits at all. Gentet and Lain should have cited these works, since pre-Pleistocene glaciations seems to be one geological arguments that compels them to make up a new model. At least they should attempt to refute these works, if they do not believe them. This tells me that the deductions of the CCC model are the result of hasty analysis.

Another example is how dinosaur tracks, eggs, and nests are so easily seen as evidence of pre-flood dinosaur activity, without analyzing previous works or seeing if the features can be made during the Flood. Gentet (2000, p. 207) proclaims:

> To speculate that dinosaurs, for just one example, would be putting down nests, laying eggs in them, etc. during such an [flood] event is beyond my comprehension.

These dinosaur data seem to be some of the main reasons for postulating a pre-flood model for the sedimentary rocks and their contained fossils, as well as for the post-Flood model (Woodmorappe, 2000). If Gentet really believes that tracks, eggs, and nests could not be made in the Flood, I would have expected a through refutation of previous work, which indicates such features can be made early in the Flood (Oard, 1995; 1997b; 1998).

Without such rigorous analysis of all the evidence that Gentet and Lain consider problematic, how can one take the CCC model seriously?

References

CRSQ: Creation Research Society Quarterly
CEN Tech. J: Creation Ex Nihilo Technical Journal
Gentet, R.E., 2000. The CCC model: a reply to Froede; Reed; Ackridge; Woodmorappe; and Klevberg. *CRSQ* 37:207.
Gentet, R.E. 2002. Response to Ackridge's reflections on the CCC model. *CRSQ* 39:141–142.
Lain, E.C. 2001. Defense of CCC Model. *CRSQ* 38:165–168.
Molen, M. 1990. Diamictites: ice-ages of gravity flows? In Walsh, R.E. and Brokks, C.L. (editors). *Proceedings of the Second International Conference on Creationism*. Volume II Technical Symposium Sessions and additional topics, pp. 177–190. Creation Science Fellowship, Pittsburgh, PA.
Oard, M.J. 1994. Submarine mass flow deposition of pre-Pleistocene "ice age" deposits in Walsh, R.E. (editor). *Proceedings of the Third International Conference on Creationism*. Technical Symposium Sessions. pp.407–418. Creation Science Fellowship, Pittsburgh, PA.
———. 1995. Polar dinosaurs and the Genesis Flood. *CRSQ* 32:237–239.
———. 1997a *Ancient ice ages or gigantic submarine landslides*. Creation Research Society Monograph No. 6., Creation Research Society books, St. Joseph, MO.
———. 1997b The extinction of the dinosaurs. *CEN Tech. J.* 11(2):137–154.

———. 1998c Dinosaurs in the Flood: a response. *CEN Tech. J.* 12(1):69–86.

Woodmorappe, J. 2000. Five letters about Gentet's CCC model (*CRSQ* 37:10–21) followed by a response from the author. *CRSQ* 37:203–204.

Michael J. Oard
34 West Clara Court
Bozeman, MT 59718

Rapid Erosion of Rock

I have performed several experiments related to the erosion rates of rocks. I always found that they erode *too* rapidly. Now I understand why. The final calculated results are very sensitive to the assumption of the final mass of the product. I assumed the final mass to be 0.001 gm, which is of the order of the mass of a grain of sand. However, "0.001 gm" is *not* "nothing," which is supposed to mean "to disappear." When I place 0 in the equation, obviously the natural log of 0 is not defined.

Table I.

Final mass	Basalt	Ironstone	Slate	Limestone	Mudstone	Corallite
0.001 gm	0.79	3.96	1.89	2.55	1.77	1.50
10^{-80} gm	14.37	71.69	36.89	48.04	31.62	28.16
10^{-300} gm	53.16	265.21	136.88	178.01	116.89	104.34

Table II.

Final mass	Basalt	Ironstone	Slate	Limestone	Mudstone	Corallite
$10^{-80}/0.001$	18.16	18.10	19.48	18.84	17.85	18.81
$10^{-300}/0.001$	67.20	66.96	72.30	69.81	66.00	69.70

Using the Hawaii Oahu rocks as an example, the average numbers of years to disappear under different final mass assumptions is shown in Table I. Using the final mass of 0.001 gm as a baseline, the ratios of the above numbers are shown in Table II.

The natural log of 10^{-300} appears to be the limit of my computer. More powerful computers may give smaller numbers for the natural logarithm. After I recalculated the numbers of my other experiments, I obtained results in the order of thousands of years for a specimen to disappear. More sophisticated computers can conceivably extend the number of years by a certain percentage.

For example, when I applied the above technique to the group of local rocks, which was partially published in the *Technical Journal* in October 1997, the average numbers of years to disappear are shown in Table III.

Table III.

Rock Types	Tumbling Effect	Waterfall Effect	W/T*
Mexican Beach Rock	15.93	4341.03	272.43
Norco Granite	8.22	1423.73	173.31
San Bernardino Granite	6.01	1888.26	314.22
Box Springs Granite	4.97	1320.93	265.61
California Desert Rock	6.21	969.48	156.19
Lava Rock	3.48	268.96	77.28
Sandstone	3.78	1007.25	266.71
Calcite	0.66	346.17	523.95

***Ratio of Waterfall/Tumbling**

The tumbling effect was obtained by subjecting the rocks to tumbling action with water. The rocks were rotated at a rate of about 60 cm/sec, causing rapid erosion and abrasion. The waterfall effect was obtained by subjecting the rocks to the bombardment of a column of water about 1.6 cm diameter. The water source was suspended about 150 cm above the rock samples in a plastic container.

The average numbers of years to disappear for the rock samples to disappear, (samples supplied by the geologist William Waisberger), from the Klamath Mountains in northern California are shown in Table IV.

Table IV.

Rock Types	Tumbling Effect	Waterfall Effect	W/T*
Amphibolite	0.78	1713.83	2187.25
Phyllite	3.73	1267.96	339.80
Quartz Vein	9.20	2518.33	273.63
Metarhyolite	13.53	3107.09	229.66
Greenstone	8.17	1911.52	234.10

***Ratio of Waterfall/Tumbling**

I hope that the above clarification will shed some light on my previous experiments.

Christopher Chui
20501 Michale St.
Canoga Park, Ca. 91306-1229
christopher_chui@juno.com

Origin of Genetic Disorders: Response to Mastropaolo

In his article "Evolution is Lethal Antiscience" (*CRSQ* 38: 151–158) Dr. Mastropaolo claims "permanent genetic extinction in this century" for the human race, based on a rapid increase in reported genetic disorders from 1966–1999 (p. 155). In my letter (*CRSQ* 39:62–63) I pointed out his data reflected the *discovery* of such disorders, not their origin in the human genome.

In his reply (*CRSQ* 39:63–64) Dr. Mastropaolo writes "He [Blievernicht] argues that once physicians surmount their naivete, then new genetic disorders are bound to decline and level off." I did not accuse physicians of naivete. It is Dr. Mastropaolo's interpretation I was challenging, not that of physicians, none of whom, so far as I know, agree with Mastropaolo on this point.

Mastropaolo writes "At the end he [Blievernicht] argues that life is indeed in a devolutionary pattern, which is the thesis of the paper that he argues against." It is the rate of devolution, not the fact of it, that is the point of debate. In his reply he provides no proof for the claim that reported genetic disorders are necessarily *new* genetic disorders, which was the main point at issue in my initial letter. Instead he claims, without reference, that genetic disorders strike earlier in succeeding generations. This tacitly acknowledges my main point, that genetic disorders were present in *prior* generations before their discovery as such in the 1966–1999 time frame!

As Dr. David Demick (1999) points out:

> ...recent research has revealed literally tens of thousands of different mutations affecting the human genome, with a likelihood of many more yet to be characterized. These have been associated with thousands of diseases affecting every organ and tissue type in the body. The medical descriptions of many forms of inherited disease have a common theme: 80–90% of cases have affected individuals in the family tree, but the remaining cases are sporadic—the result of ever increasing numbers of new mutations.

These data suggest that new mutations account for no more than a small percentage of observed genetic disorders, the remainder being transmitted from their origin in generations past. The percentage may be less, since medical information on members of a family tree is sometimes limited or nonexistent.

Mastropaolo also asserts, "Yet in spite of these medical advances, birth defect fatalities continue to increase exponentially." This is based on his interpretation of Figure 5 in his paper, showing an increase in the *proportion* of infant deaths attributable to birth defects. These are two totally different things, and Mastropaolo's claim that birth defect fatalities are increasing "exponentially" is flatly incorrect. They are not increasing exponentially. They are not increasing at all. In fact they are decreasing.

According to the Centers for Disease Control (1998) from 1980–1995 infant mortality for all causes declined 39.8% in the United States. Infant mortality due to birth defects declined a lesser amount, 34.2%, so the proportion of deaths due to birth defects increased as shown in Mastropaolo's chart. As the CDC stated, "Birth defects are the leading cause of infant mortality, but infant mortality attributable to birth defects (IMBD) has not declined as rapidly as overall infant mortality." But the point is that the actual rate of deaths due to birth defects declined by over a third—hardly the exponential increase Mastropaolo claimed.

Overall IMBD declined from 2.6 per thousand births in 1980 to 1.7 in 1995. At present therefore improvements in medical care are outpacing the increasing genetic load carried by the human race. Human extinction due to genetic defects is not imminent as Mastropaolo claimed, it is not even foreseeable.

References

Centers for Disease Control. 1998. Trends in infant mortality attributable to birth defects, 1980–1995. *Morbidity and Mortality Weekly Report* 47:37.

Demick, David. 1999. The blind gunman. *Institute for Creation Research Impact* No. 308.

Eric Blievernicht
940 E. Sunset Pike
Terre Haute, IN 47802
Ebliever@earthlink.net

Stellar Formation

Most disturbing, however, is the fact that despite numerous efforts, we have yet to directly observe the process of stellar formation. We have not yet been able to unambiguously detect the collapse of a molecular cloud core or the irifall of circumstellar material onto an embryonic star. Until such an observation is made, it would probably be prudent to regard our current hypotheses and theoretical scenarios with some degree of suspicion.

C.J. Lada and F.H. Shu, *Science*, 248:572 (1990).

Instructions for Authors

Submission

Three paper copies and a computer file shall be submitted to the editor of the *Quarterly*. Each copy should have a title page with only the title, author contact information, and a list of key words for subjects covered in their articles. The second page should have the title, no author information, and the rest of the article to allow anonymous reviewing.

Authors must realize that the editors will subject their papers to changes as necessary, in order to make them more suitable for the broad spectrum of *CRSQ* readers. If the revisions of the editor and referees are extensive, the changes will be sent to the author to be incorporated in the final draft. If the changes are not acceptable to the author, he may withdraw his request for publication, or he may request that the changes be examined by another editor, whose decision will be final.

All submitted articles will be reviewed by at least two technical referees. The editor may or may not follow the advice of these reviewers,and the author may defend his position against referee opinion. After the peer review is finished and all changes have been made to the article, a final paper copy and computer file will be requested. Authors who provide either an email address or fax number will receive a copy of their article just prior to publication. Materials will not be returned to authors unless accompanied by a self-addressed, stamped envelope.

The *Quarterly* is a journal of original writings. Only under unusual circumstances will we reprint previously published manuscripts. Never submit an article to two or three journals, including ours, hoping all of them will publish your work. When submitting an article, please state if the material has been published previously or has been submitted to other journals.

Appearance

Manuscripts shall be computer-printed (or typed) and double-spaced. If you are unable to provide a copy of your paper on computer disk, one final paper copy should have no handwritten marks of any kind in the text area, although you may write page numbers at the bottom of each page.

Although it is nicer to be positive, there seem to be a lot of important negatives:

- Do not indent the first word of each paragraph; separate paragraphs by an extra blank line instead.
- Never press the space bar more than once *anywhere*, not even at the ends of sentences.
- Do not split words with hyphens at the ends of lines.
- Do not use all capital letters for *anything* (titles, etc.).
- Do not use bold type in the paragraphs; use italics to call attention to words.
- Do not use multiple spaces for tables and similar material. Use tabs instead.
- Do not use dashes (—) for definitions, but use colons instead, e.g., "NR: Not recorded." Where dashes are appropriate, to indicate a pause in thought, please use *two hyphens* (with no spaces on either side) if your word processor does not offer an actual dash.

Each footnote should be included *in the text*, surrounded by [brackets], immediately after the text to which the footnote applies.

All figures and drawings must be of high quality, therefore, no sloppy drawings or lettering will be accepted. Use patterns, rather than shading, in line drawings. Unacceptable illustrations will result in rejection of the manuscript for publication. Do not embed pictures in text files.

References and Book Reviews

References should be in the current *Quarterly* style. Additional references with *identical* authorship should be preceded by three underline characters in place of the name(s). The examples below should cover most possibilities.

CRSQ: *Creation Research Society Quarterly*. [for multiple *Quarterly* references]

Cockman, Joneen. 1988. Collecting plants for the Creation Research Society Herbarium. *CRSQ* 24:187–193.

Margulis, Lynn. 1971a. The origin of plant and animal cells. *American Scientist* 59:230–235.

———. 1971b. *Origin of eukaryotic cells*. Yale University Press, New Haven, CT.

Hitchcock, A. S. 1971. *Manual of grasses of the United States*. Dover Publications, New York.

Walker, Tasman B. 1994. A biblical geologic model. In Walsh, R.E. (editor), *Proceedings of the third International Conference on Creationism* (technical symposium sessions), pp. 581–592. Creation Science Fellowship, Pittsburgh, PA.

Book review headings, like references, have a particular style which should be followed. This issue of the *Quarterly* will provide examples.

Length

Manuscripts containing more than 25 pages are discouraged. If a topic cannot be covered to the author's satisfaction in this number of pages, the author should divide his material into separate papers that can be serialized in the *Quarterly*. Book reviews should be limited to 1000 words.

Errata

In the March, 2003 *CRSQ*, the letter on p. 279, "Flood Geology Does Not Explain the Fossil Record" should have had the author information at the end:

E.C. Lain
915 W. Miner St. Apt. 45
Yreka, CA 96097
Edlain@snowcrest.net

In the December, 2002 *CRSQ* on p.203, the reference:

Hunter, M.J. 2000b. Fossils and the pre-Flood boundary at the base of the earth's transition zone. *CENTJ* 14(1): 60–74.

should read:

Hunter, M.J. 2000b. The pre-Flood/Flood boundary at the base of the earth's transition zone. *CENTJ* 14(1):60–74.

Book Review

The Right Questions: Truth, Meaning and Public Debate by Phillip E. Johnson
Intervarsity Press, Downers Grove, IL. 2002, 191 pages, $16

This is a disturbing publication; the essence summarized well in its final paragraph:

> Above all, what went wrong in the developed countries where science predominates was that the prevailing culture, through its opinion-makers, gave up on the search for truth. They sorted all thoughts into two baskets, "religion" and "science." Then they kept everything in the "science" basket, however contrary to the evidence, and threw out everything in the "religion" basket, however, often it had been confirmed by experience. That left the most technologically advanced societies with a definition of knowledge that allowed knowledge only of means and relegated all questions of ultimate ends to the realm of subjectivity and speculation. Like a traveler without a map or a compass, these societies no longer had any knowledge of where they should be going. Not surprisingly, they lost their way (p. 191).

Lawyer Phillip Johnson is a retired University of California professor who justifiably may be identified as today's most visible and influential anti-evolutionist (molecules to man theory), and he relentlessly opposes the atheistic mindset characteristic for most scientists. He feels that the evolutionary view represents a "disastrous accommodation" (p. 137). The book is Johnson's sixth since he initiated his attack against Darwinian naturalism (materialism or atheism); and as Nancy Pearcey says in her excellent 19-page Forward, "this current book is the most personal of Johnson's published works" (p. 8).

The text deals with the main evolution vs. anti-evolution issues and not with other matters which are controversial among anti-evolutionists themselves. The most personal intimate sections begin in chapter three where Johnson relates how he, just past age 61 in 2001, responded to and was restored from a debilitating stroke. As a result he realized in a powerful manner that Jesus Christ is the foundational rock of his life (pp. 86-92; Matthew 7: 24).

Johnson further stresses the importance of biblical revelation and emphasizes particularly the early verses of Genesis and in the Gospel of John. More than two dozen questions are proposed and amplified by Johnson who clearly identifies himself as a Christian. His Ultimate Question is "What is the Most Important Event in Human History?" For Johnson, the answer is God's becoming human in the person of Jesus Christ and Christ's resurrection. These are vitally important Christian doctrines, but I would have included the crucifixion of Christ which was necessary for the forgiveness of sin. The symbol of the cross points us back to this pivotal event. However, Johnson did recognize that he had a sinful nature (p. 98), and he offered "the hypothesis that the underlying defect in Marxist theory was that it contained no provision for sin, which is the inherent corruptibility of human nature" (p. 180).

Johnson does not directly answer every question he presents in the book, but he provides ideas about what the answers may be. Many current issues involving politics and religion (including Islam) are covered. Johnson appropriately understands that genome research has not produced expected patterns for differences among organisms. Especially for Christian educators and other intellectuals, the book is well worth reading, pondering, and reacting on the basis of Johnson's recommendations that include the revamping of popular science teaching in our educational institutions.

Wayne Frair
1131 Fellowship Road
Basking Ridge, NJ 07920-3900

Creation Research Society
Membership/Subscription Application and Renewal Form

The membership/subscription categories are defined below:

1. **Voting Member**	Those having at least an earned master's degree in a recognized area of science.
2. **Sustaining Member**	Those without an advanced degree in science, but who are interested in and support the work of the Society.
3. **Student Member**	Those who are enrolled full time in high school or undergraduate college.
4. **Senior Member**	Voting or sustaining members who are age 65 or older.
5. **Life Member**	A special category for voting and sustaining members entitling them to a lifetime membership to the Society.
6. **Patron Member**	A special category for voting and sustaining members who either make a one-time $2,500 contribution to the Society's general fund, or contribute $500/year for five years. A Patron Member receives a life-time subscription, a plaque, and has his or her name listed in the *Quarterly* each year.
7. **Subscriber**	Libraries, churches, schools, etc., and individuals who do not subscribe to the Statement of Belief.

All members (categories 1–6 above) must subscribe to the Statement of Belief as defined on the next page.
Please complete the lower portion of this form, and mail it with payment to the membership secretary:

Dr. Glen W. Wolfrom, Creation Research Society, P.O. Box 8263, St. Joseph, MO 64508-8263

✂- -

This is a ☐ new ☐ renewal application for the subscription year beginning June ☐ 2001, ☐ 2002, ☐ ________.

Please Type or Print Legibly

Name________________________________Address________________________________

City______________State____________Zip________Country______________________________

Degree____________Field____

Year granted__________Institution____

Presently associated with ____

I have read and subscribe to the Creation Research Society Statement of Belief.

Signature____Date________________

Check Appropriate Category:

☐ Voting	☐ Regular	$29
	☐ Senior	$24
	☐ Life	$350
	☐ Patron	$2500
☐ Sustaining	☐ Regular	$29
	☐ Senior	$24
	☐ Life	$350
	☐ Patron	$2500
☐ Student		$24
☐ Subscriber		$32

Item	Amount Due
Member/Subscriber	$__________
Added $7 charge for orders outside U.S.A.	$__________
Optional contribution	$__________
Books	$__________
Total Due	$__________

☐ Visa ☐ Master Card ☐ Discover ☐ American Express

Card number ________________________________

Expiration Date (mo/yr)__________________________

Signature________________________________

Foreign orders, including Canadian, *must* be made in U.S. dollars by a check drawn on a U.S. bank, international money order, or credit card.
Please do *not* send cash.

Student Members (high school or undergraduate college) are requested to complete the following:

High school or institution now attending ____

Your year in school______Year you expect to graduate______Major if college student____________________

Signature ____

Order Blank for Past Issues

Cost of complete volumes (per volume): members (all categories) $22.00
nonmembers and subscribers (libraries, schools, churches, etc.) $25.00
Cost of single issues (per issue): members (all categories) $6.00
nonmembers and subscribers (libraries, schools, churches, etc.) $7.00

	Number					Number					Number			
Volume	**1**	**2**	**3**	**4**	**Volume**	**1**	**2**	**3**	**4**	**Volume**	**1**	**2**	**3**	**4**
1	☐	☐	☐	☐	14	☐	☐	☐	☐	27	☐	☐	☐	☐
2	☐	☐	☐	☐	15	☐	☐	☐	☐	28	☐	☐	☐	☐
3	☐	☐	☐	☐	16	☐	☐	☐	☐	29	☐	☐	☐	☐
4	☐	☐	☐	☐	17	☐	☐	☐	☐	30	☐	☐	☐	☐
5	☐	☐	☐	☐	18	☐	☐	☐	☐	31	☐	☐	☐	☐
6	☐	☐	☐	☐	19	☐	☐	☐	☐	32	☐	☐	☐	☐
7 ☐	(complete volume only)				20	☐	☐	☐	☐	33	☐	☐	☐	☐
8 ☐	(complete volume only)				21	☐	☐	☐	☐	34	☐	☐	☐	☐
9	☐	☐	☐	☐	22	☐	☐	☐	☐	35	☐	☐	☐	☐
10	☐	☐	☐	☐	23	☐	☐	☐	☐	36	☐	☐	☐	☐
11	☐	☐	☐	☐	24	☐	☐	☐	☐	37	☐	☐	☐	☐
12	☐	☐	☐	☐	25	☐	☐	☐	☐	38	☐	☐	☐	☐
13 ☐	(complete volume only)				26	☐	☐	☐	☐	39	☐	☐	☐	☐

Make check or money order payable to Creation Research Society. Please do *not* send cash. Foreign orders, including Canadian, please use a check in U.S. funds drawn on a U.S. bank, an international money order, or credit card.

(Please print clearly or type)

Name ____

Address ____

City,State______________ZIP________________________

Country ____

Add 20% for postage
(minimum $4.00, maximum $20)
(foreign minimum $5, no maximum)

Total $____________________

Mail to:
Creation Research Society
P.O. Box 8263
St. Joseph, MO 64508-8263

☐ MasterCard ☐ Visa ☐ Discover ☐ American Express Card No.____________________Exp. Date (mo/yr) ____

Date_________________Signature____

Creation Research Society

History—The Creation Research Society was organized in 1963, with Dr. Walter E. Lammerts as first president and editor of a quarterly publication. Initially started as an informal committee of 10 scientists, it has grown rapidly, evidently filling a need for an association devoted to research and publication in the field of scientific creation, with a current membership of over 600 voting members (graduate degrees in science) and about 1000 nonvoting members. The *Creation Research Society Quarterly* has been gradually enlarged and improved and now is recognized as the outstanding publication in the field. In 1996 the *CRSQ* was joined by the newsletter *Creation Matters* as a source of information of interest to creationists.

Activities—The society is solely a research and publication society. It does not hold meetings or engage in other promotional activities, and has no affiliation with any other scientific or religious organizations. Its members conduct research on problems related to its purposes, and a research fund is maintained to assist in such projects. Contributions to the research fund for these purposes are tax deductible. As part of its vigorous research and field study programs, the Society operates The Van Andel Creation Research Center in Chino Valley, Arizona.

Membership—Voting membership is limited to scientists who have at least an earned graduate degree in a natural or applied science and subscribe to the Statement of Belief. Sustaining membership is available for those who do not meet the academic criterion for voting membership, but do subscribe to the Statement of Belief.

Statement of Belief—Members of the Creation Research Society, which include research scientists representing various fields of scientific inquiry, are committed to full belief in the Biblical record of creation and early history, and thus to a concept of dynamic special creation (as opposed to evolution) both of the universe and the earth with its complexity of living forms. We propose to re-evaluate science from this viewpoint, and since 1964 have published a quarterly of research articles in this field. All members of the Society subscribe to the following statement of belief:

1. The Bible is the written Word of God, and because it is inspired throughout, all its assertions are historically and scientifically true in all the original autographs. To the student of nature this means that the account of origins in Genesis is a factual presentation of simple historical truths.
2. All basic types of living things, including humans, were made by direct creative acts of God during the Creation Week described in Genesis. Whatever biological changes have occurred since Creation Week have accomplished only changes within the original created kinds.
3. The Great Flood described in Genesis, commonly referred to as the Noachian Flood, was a historical event worldwide in its extent and effect.
4. We are an organization of Christian men and women of science who accept Jesus Christ as our Lord and Savior. The act of the special creation of Adam and Eve as one man and woman and their subsequent fall into sin is the basis for our belief in the necessity of a Savior for all people. Therefore, salvation can come only through accepting Jesus Christ as our Savior.